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November, 1961

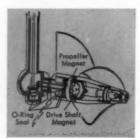


James F. Meisner, County Engineer for Marion County, Kansas, is shown at the County Park and Lake which were built according to his design and under his supervision. His principal responsibilities concern the county road system, one of the best in the State of Kansas. See page 18 for more data.



DIRECT TOTALIZATION on straight reading totalizer gives total flow information at a glance.





MAGNET IN PROPELLER assures a completely sealed meter transmission—eliminates packing gland. Requires no maintenance lubrication.

Hermetically Sealed - Sparling Masterflo Main-line Meters Operate Perfectly-Even Submerged

WATERPROOF • CORROSIONPROOF • Wherever there is the hazard of a flooded meter pit or excessive exterior water the Sparling, hermetically sealed, Masterflo maintains accurate metering. Air-tight, water-tight Indicator-Totalizer continues to register direct totalization and show rate of flow under most adverse conditions to prevent service interruption, expensive downtime, loss of record, needless repair costs.

MAGNETIC DRIVE • Further meter protection is assured through the exclusive Sparling hermetically sealed head assembly. No water, grit or dirt can get into the water transmission. Dual radial magnets transmit propeller rotation through the sealed housing to the drive shaft eliminating packing glands; minimizing friction; locking out water. Excessive torque or load on the propeller will cause the magnets to "slip" before damage occurs. Lifetime lubrication is included in factory assembly.

The Sparling Masterflo is the ultimate in Main-line metering. Its performance, protection, dependability are worth the slight additional cost. Ask your Sparling field engineer.



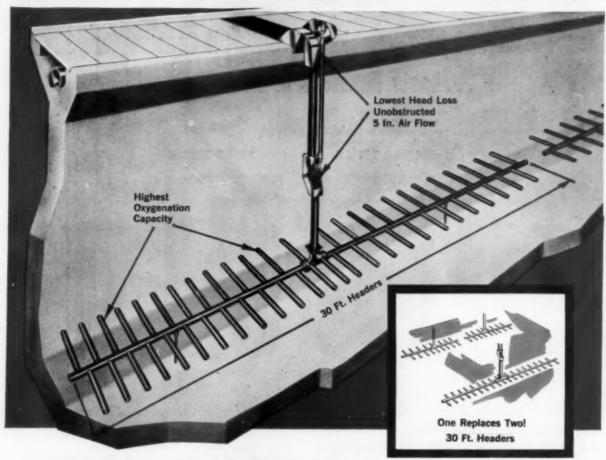
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METER COMPANY
Sparling Equipment: EL MONTE, CALIF.
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Branches: Atlanta · Chicago · Cleveland · Dallas · Denver · Kansas City, Mo. · Roselle, N. J. · San Francisco · Seattle · United Kingdom Affiliate: TYLORS OF LONDON LTD

Whicago NEW SWING DIFFUSER...

DESIGNED FOR HIGHER CAPACITIES . . . LOWER COSTS



"MODEL 30" SWING DIFFUSER PROVIDES GREATER ECONOMY WITH INCREASED OXYGENATION CAPACITY

- Highest oxygenation capacity . . . positive positioning of 5 inch diameter Swing Diffuser with loadings up to 115 "Precision" Diffuser Tubes.
- Lower head loss . . . Exclusive unobstructed air flow construction makes over 280% more air available from the Model 30 than is obtained from any single conventional unit; 40% more air than obtained from any two conventional units—at no increase in head loss.
- Headers are 30 feet long . . . fewer swing diffuser units necessary, lower installed costs.
- Air leakage eliminated . . . unique, sealed flexible

- connections eliminate leakage normally encountered through metal to metal faced joints.
- Lubrication eliminated . . . Stainless steel and Teflon lined joints eliminate need for lubrication.

IN ADDITION, the new Model 30 Swing Diffuser provides all the advantages of the famous "Chicago" Swing Diffusers proved successful in thousands of installations. Individual units are easily raised for cleaning and inspection without interruption of tank operation.

Ask for Bulletin No. 179



HYDRODYNAMICS DIVISION

CHICAGO PUMP

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*U. S. PATENT NO. 2997284 Others Pending. Special report to users of Caterpillar D7, D8 and D9 Tractors:



New Piston and Ring Combination Cuts Oil Consumption 33-50% ... Lasts Hundreds of Hours Longer!

4-RING DESIGN



NEW 3-RING DESIGN



What makes it so different? Look at the two Caterpillar-made pistons. Notice in the new design that both compression rings are now deeply seated in grooved cast iron (indicated in yellow) instead of only the top ring. Since cast iron is able to resist groove "pound out," both compression rings are held firmly longer in the correct position for maximum ring-to-liner sealing. Compression loss and blow-by behind rings and around grooves is delayed hundreds of hours, too.

The new intermediate compression ring is a "twist" ring, so-called because it changes position in the groove during the power stroke. It actually "twists" so its face has greater sealing area at the liner than regular rings-reducing the number of compression rings normally required. At the same time, it thins the film of oil left by the regular oil

control ring. This leaves less oil to burn away which contributes to the new piston's better oil control and longer ring life.

All rings now have a new look, too . . . each and every face is thickly chrome plated against wear. They are also "bright lapped" to such brilliance that any flaws can be easily seen and the faulty ring rejected. Such quality control assures almost perfect seating right from the start, eliminating break-in blow-by, slobbering and scuffing.

Cost? Pistons with the extra cast iron bands cost slightly more, but ring sets are less! Once you change over, your tractor maintains its power longer, your fuel and oil bills go down, and your next set of replacement rings will be less. Your Caterpillar Dealer has them in stock now.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

Tractors • Motor Graders

PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

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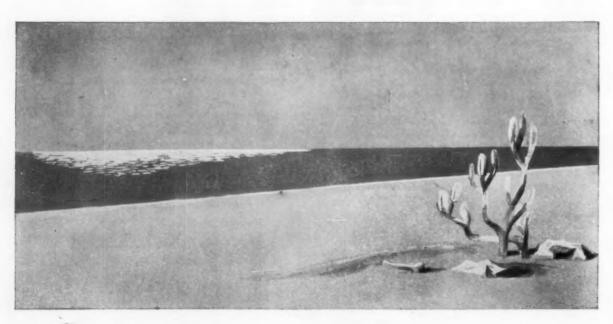
site for a town that drinks nothing but **SEA**

Sun-baked desert, parched and waterless—not a very promising site for a town. But, with the development of the Richardsons Westgarth multi-stage vacuum flash sea-water evaporator, it is now economically feasible for towns in arid coastal countries to draw all their fresh water from the sea.

These evaporators were pioneered in Great Britain by Richardsons Westgarth. The largest of them could distill 2,000,000 gallons of sea-water a day—enough for a town of 250,000 inhabitants—and the distillate is purer than many mains water supplies from conventional sources.

Richardsons Westgarth evaporators are at work in South America, the Middle East and elsewhere, providing fresh water for both domestic and industrial applications.

These units are at their most economical when used in conjunction with low-pressure steam or back-pressure turbines and, as manufacturers of most of the major equipment for power generation, Richardsons Westgarth are particularly well qualified to carry out completely integrated schemes.





RICHARDSONS, WESTGARTH & CO. LTD.

The Controlling Company of the Richardsons Westgarth Group, Wallsend, Northumberland, England, and at 58 Victoria Street, London, S.W.1.

RW70



How Much Did You Spend on Pavement Maintenance Last Year?

THERE is a growing concern among highway officials about maintenance costs—which are growing also. Unfortunately, the concern stems in part from a lack of reliable data on which to evaluate this major annual expenditure. Many highway departments with exact and accurate unit price records on every cubic yard of concrete or gallon of asphalt used in new construction for the last decade, cannot tell how many maintenance dollars were spent last year per unit of work on pavement or structure. This is not a very firm basis on which to build a better maintenance program—and a better one must be developed to protect the tremendous investment now being made in new highways.

AASHO and HRB committees are studying the problem on a state level. APWA has a study underway that will encompass local road and street maintenance costs. No committee or association, however, can compensate for a lack of proper accounting practices by the separate maintenance departments. Before we can have uniform maintenance cost accounting on a national level, we must have efficient cost accounting on a local level.

A Problem for Engineers, Contractors and Manufacturers

ONE OF THE big problems in nearly every city, county and state is how the responsible engineer shall keep informed of the latest construction methods, techniques, equipment and materials so that the applicability of these to construction and maintenance of public works may be determined. It is not enough for the contractor to know these factors; if the engineer does not know them also, proposals for their employment may meet objection.

Public works engineers are generally well qualified by training and experience. However, developments in methods, materials and equipment are numerous and keeping up with all of them is a task that would be expedited by cooperation on the part of manufacturers and contractors. Such cooperation might take the form of brief and to-the-point descriptions which tell what can be done, why the new method is better or lower in cost and how it is to be used. Written in sound engineering language, such information could be helpful to all.

Water Consumption, Water Use and Water Shortages

THERE IS some confusion as to what constitutes water consumption and what is water use. Even our own editors have occasionally failed to draw the proper distinction between the two. A result has been that the public and the so-called popular magazines have visions of a not distant day when getting enough water will be a serious problem. If the total of all uses are added together, a shortage appears imminent in the near future; but when it is realized that many uses are not consumptive-power production, cooling, much of the domestic and much of the industrial-but merely use and return of the water to the stream from whence it came, the picture is not so bleak. Most of the water shortages reported to date have been due to inadequacies of pumping and/or treatment plants or more often to lack of capacity of distribution piping. These defects can be corrected; and so can the loss of usable water due to lack of adequate waste water treatment. We have the skills available to solve both problems.

Peak Floods and Flood Plain Encroachments Present Greater Problems

THOUGH RAINFALL intensity may be no greater now than it was a century ago, downstream peak discharges may be two or three times as great. This is especially the case when urban or suburban developments in tributary areas result in a loss of surface storage, a marked increase in impervious area and a reduced time of concentration. When these elements are combined with flood plain encroachment, a great deal of damage is sure to result, even with less than maximum storms.

The intensity of rainfall cannot be changed; it cannot even be anticipated, except generally. It is unlikely that engineering standards for streets, for other structures and for development layouts can be modified to detain materially storm water runoff, though some general measures for doing this have been under consideration. The only other palliative is to reduce flood damage by a more realistic approach to controlling encroachments on flood plains. This will be a costly and difficult matter, yet it is one that needs most serious consideration.

Rugged pipe installs easily -even in a soggy bed

This 30" cast iron pipe was installed for expansion of a water system in Memphis, Tennessee.

Despite heavy rains, the pipe went right to bed in wet trenches. Upon completion, the mains were tested at 150 psi for 12 hours and were found to be bottle-tight.

Cement-lined cast iron pipe prevents pipe-clogging ... always delivers a full flow of water. Bottle-tight joints are tight enough to resist hundreds of pounds of pressure per square inch... yet flexible enough to permit deflection both during and after installation.

Rarely requiring repair or replacement, cast iron pipe performs efficiently, day after day, for over a century.



CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

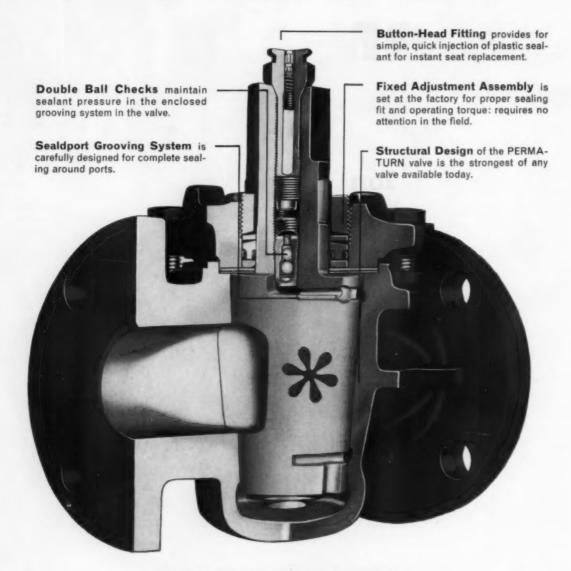
CAST IRON PIPE RESEARCH ASSOCIATION
Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Illinois



PUBLIC WORKS for November, 1961

Announcing:

an exciting new concept in valves



THE STANDARD PERMATURN DESIGN

(available also in Hypreseal design for high pressures)

HEART OF THE PERMATURN VALVE

A unique design feature in the Rockwell PERMATURN valve is its coated plug. Selected after extensive testing during the five year PERMATURN development program, the coating material has an extremely low coefficient of friction and is applied so that it is permanently bonded to the metal surface of the plug.

This tenacious, durable dry film lubricant gives perma-

nent separation of metal surfaces of plug and body, preventing sticking and assuring smooth, easy quarter-turn operation always. The coating is inert to all normal liquids or
gases and has proved its durability, both in torture tests
conducted in Rockwell research laboratories and in numerous field installations made throughout the country
to confirm these results.

The Rockwell

PERMATURN

Valve

offering long life, ease of operation and attention-free performance in water and sewerage services

Out of a background of 40 years' leadership in valve research comes the newest, most significant development of this decade: the PERMATURN valve line.

Fully tested for five years in Rockwell's own modern laboratories . . . and fieldproved before introduction . . . the PERMATURN valves are the first to combine all the most wanted valve features in a full line available in all sizes, from 1/4" to 36", and for all normal pressures, to 10,000 psi.

Here are the advantages offered by this new valve; advantages that have not been available in any single valve design until this time:

ATTENTION-FREE PERFORMANCE

In many non-critical valve services, users place a premium on a valve that can be installed and forgotten: that needs no attention. Where such simple fluid control services are involved, the Rockwell PERMATURN valve can be operated without attention, and with excellent performance results.

EASY, 90°-TURN OPERATION

Address City

Fast opening and closing are easier with the new Rockwell PERMA-TURN than with any other valve ever developed. It's just a quick, smooth quarter-turn from full-open to shut-off with these valves, and their unique design assures low-torque operation alwaysthat's where the name PERMATURN comes from!

Zone State

"PUSH-BUTTON" SEAT REPLACEMENT

And here's a feature you'll find in no other type of valve: you can put a new seating surface in the new PERMATURN valve in seconds and without loosening a single bolt-all from the outside. You can replace the PERMATURN valve seats as often as you like more putting up with leaky valves until maintenance crews can tear them down. You add years of life-and save money-with this performance-extending feature of Rockwell PERMATURN valves.

DROP-TIGHT SEALING

There are some valve applications where there's just no substitute for the bottle-tight, wear-defying characteristics of the new Rockwell PERMATURN valve used with a regular program of sealant replacement. And in these critical services, the PERMATURN valve has dramatically reduced operating torque requirements.

SEND FOR COMPLETE INFORMATION

Rockwell Manufacturing Co. 173L N. Lexington Ave., Pittsburgh 8, Pa Please send me a copy of your Pocket Valve Guide to Rockwell PERMATURN valves. Name Title Company

another fine product by ROCKWEL

ROCKWELL PERMATURN VALVES





Sewage Capacity Doubled while Standby Unit Insures Service!

"At this critical point, a reliable engine is imperative. We can depend on this International whether we pump for just a few hours, or handle the entire flow 24 hours per day."

> —Superintendent Jack Barfield, S. N. Nielsen Co., Inc. Chicago, Ill.

Sewage treatment capacity for the city of Elmhurst, Ill. (population: 34,000) was increased from three to six million gallons per day by the addition of new facilities to the existing plant. During construction, an International UD-282 Diesel engine powered a 3,000-gpm pump to transfer raw sewage through a 150-ft. temporary line to a diversion box. It was then distributed to various primary treatment tanks. By-pass around the main pump was necessary for installation of new sewage grinder and grit collector chamber. Throughout the entire job, the reliable International Diesel supplied failure-proof power for this critical operation.

Find out how easy it is to extend dependable, lowcost International power to all of your heavy-duty



municipal applications. Before you specify engines for generators, pumps, construction machinery, or auxiliary units, check the wide range of power in the IH line. For complete information and installation assistance call your nearby International Engine Distributor or Dealer.

HENGINES

International Harvester Co., 180 North Michigan Ave., Chicago 1, III.

A COMPLETE POWER PACKAGE

PUBLIC WORKS for November, 1961

ON HIGHWAYS AND ROADS

GET AT THE ROOT OF YOUR WEED CONTROL PROBLEM



ATRAZINE SIMAZINE

HERBICIDES

Geigy industrial herbicides make possible full season weed control from one application.

Atrazine or Simazine controls both broadleaf weeds and grasses—are non-irritating and low in toxicity to humans and animals. Both provide ease and economy in use.

Plan now to get at the root of your weed control problem. Your supplier has Geigy industrial herbicides in wettable powder or granular form. For free information call him today or write—Geigy Agricultural Chemicals, Division of Geigy Chemical Corporation, Saw Mill River Road, Ardsley, New York.



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Division of Geigy Chemical Corporation . Saw Mill River Road, Ardsley, N.Y.

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1,500,000 gallons-Wheaton, Ill.



750,000 gallons - Rochester, Mich.



500,000 gallons - Lewisville, Tex.



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FORT WORTH WATER DEPARTMENT

Horton Spheroidals

for BONUS CAPACITY

The 2,000,000 gallon Horton Spheroidal elevated tank in Ft. Worth, Texas, is a graceful symbol of contemporary, efficient water storage.

An original CB&I design introduced in 1958, the spheroidal tank requires less steel than conventional designs. The economies are readily apparent, often resulting in bonus capacity at very little additional cost over other designs. Capacities range from 200,000 to 3,000,000 gallons.

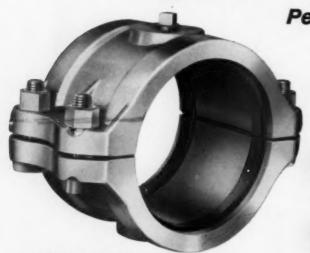
This is another example of how CB&I's ingenuity in design, crafts-manship in steel, and complete responsibility from start to finish can be beneficially applied to your water storage tank. For additional infor-

mation, contact Chicago Bridge & Iron Company, 332 South Michigan Ave., Chicago 4. Ask for Brochure A-30, "Elevated Steel Storage Tanks."



NEWCLOW

Ductile Iron Split Sleeve



ASSEMBLED IN 3 EASY STEPS

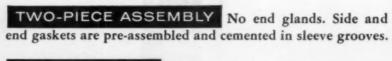
Permits easier, quicker,
permanent repair of
4", 6" & 8" transverse
cast iron pipe
underground breaks

LIGHT WEIGHT Assembled 4" diameter sleeve weighs but 26 lbs. Weight of 6" sleeve is 32 lbs., 38 lbs. for 8" sleeve.

SHORT LENGTH Effective length of 4 inches between end seals on all sizes. Overall length is 61/4".



Once the damaged pipe is uncovered, one half of the sleeve is placed on each side of the pipe.



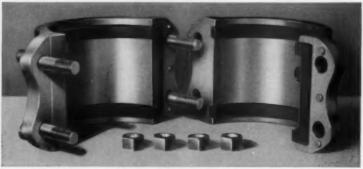
HIGH STRENGTH All parts are high tensile and corrosion-resistant. Sleeve halves are 70,000 psi tensile ductile iron. Nuts and bolts are high strength, corrosion-resistant alloy.



Sleeve halves are drawn together. Pre-assembled rubber gaskets make tight seal.



After the bolts are taken up fingertight, tightening the four bolts by wrench completes assembly.



HERE'S ALL THERE IS TO IT! Illustration shows twopiece glandless construction. Side gaskets overlap ends of circumferential gaskets for tight seal. Four bolts are only accessories. Tapping boss on each half allows maximum tap of 2 inches. Regularly furnished with one sleeve-half tapped for ¾" pipe.

JAMES B. CLOW & SONS, INC.

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Subsidiaries:

Eddy Valve Company, Waterford, New York Iowa Valve Company, Oskaloosa, Iowa



6113

How to get deepest penetration of granular materials

The answer is vibration-4200 three-ton blows per minute from the sturdy, rubber-mounted shoes of a GALION VIBRATORY COMPACTOR. Nothing else is so efficient in compacting granular base materials, because nothing else can "shake down" particles far below ground level—yet leave a smooth, flat surface.

Use this compactor with a GALION 3-WHEEL ROLLER for a time-saving combination of static and vibratory compaction. Or mount it on a GALION 503 GRADER (see photo above) to spread, level and compact in one operation. Either way, you get double efficiency—save on man-hours and equipment costs.

Important features: Vibratory Compactor can be operated with roller or grader moving forward or reverse. Engine and generator can be used as auxiliary

lighting plant or for powering small tools. Individual compactor shoes can be detached, fitted with handle and used for compacting confined areas.



See your Gallon distributor for further information or write for literature.

THE GALION IRON WORKS & MFG. COMPANY, Galion, Ohio, U.S.A. General and Export Offices, Galion, O., U.S.A., Cable Address, GALIONIRON, Galion, O.

TAKE A GOOD



Here's tangible benefits of using an Asplundh Chipper.

- · Considerable savings
- · Capable performance
- · Low maintenance

Made by tree men. No brush chipper has been put to such severe test. You get a modern design chipper that combines the on-the-job practicability with a pleasing appearance that's sure to create better public relations.

Take a good look. A free no-obligation demonstration will give on-the-spot information. Observe the taper blades in action—the 300 lb. flywheel providing constant, fast, uniform chipping action—the ease of tracking.

Write today for your illustrated specifications on the Asplundh Brush Chipper.

ASPLUNDH CHIPPER COMPANY

HAMILTON STREET, CHALFONT, PENNA.

Mfg. Division of Asplundh Tree Expert Co.

About Our Cover



James F. Meisner, engineer of Marion County, Kansas, since 1931, is shown on our cover against the background of the County Lake and Park which were built according to his design and under his supervision. Born on a farm in Kansas, he was graduated from the University of Kansas in 1927 with a BSCE degree. Except for brief intervals he has been engaged in county engineering work since graduation, first with Douglas County and, after a year with the Illinois Highway Department, again with Douglas County and finally with Marion County.

Mr. Meisner has been active in many phases of county engineering. He has written several excellent articles which have appeared in Pun-LIC WORKS; during the past several years he has served as chairman of the Kansas County Engineers' Legislative Committee which has been instrumental in repealing many obsolete laws and in revising and updating most of the others; he is a member of Committee No. 5 of the National County Engineers' Association which is preparing a "Manual on Maintenance" designed to provide uniform definitions and accounting procedures; he is also Civil Defense Director for Marion County and chairman of the County Red Cross. This dual role serves to insure coordination of private or volunteer and official responsibilities in case of disaster.

He was listed in "Who's Who in Engineering" in 1948, not because of any spectacular achievement but because consistently, year after year a sound, stable road system served the people in every part of the county. Mr. Meisner says he cannot point to any showy project but believes Marion County has one of the best overall road systems of any county in the State.

His activities cover a wide range. He is an active Elder in the Presbyterian Church and teaches an adult Sunday School Class. Among his hobbies are collecting stamps, First Day covers and key coins; he designs his own Christmas cards. Recently he took a personal

part in the Kansas Centennial by growing a jaunty set of whiskers. The accompanying picture shows him with this decoration.

Mr. and Mrs. Meisner have two children, a daughter who is a graduate of the University of Kansas and a son who is a high school senior.





FOR THE

When a city must go 100 miles for a sufficient supply of potable water, authorities demand a reliable medium for its transmission to the community. That's why Oklahoma City selected LOCK JOINT PRESTRESSED CONCRETE EMBEDDED CYLINDER PIPE to carry its vital supply of pure water from Atoka Reservoir to the state's capital.

The long life, permanent high carrying capacity and negligible maintenance inherent in Lock Joint Concrete Pressure Pipe make it ideal for the construction of this 60" aqueduct -the longest continuous water line ever built in the United States.

Economically, Lock Joint Pipe is also ideal. In addition to long term savings effected in low pumping costs and minimum maintenance, the production of the pipe locally at Ada will plow back more than \$6,000,000 into the economy of the area through the use of local labor, services and materials.



LOCK JOINT PIPE CO.

Established 1905 P. O. BOX 269, EAST ORANGE, N. J.

Member of The American Concrete Pipe Association and The American Concrete Pressure Pipe Association CONCRETE PRESSURE, SEWER, CULVERT & SUBAQUEOUS PIPE: PLASTIC PIPE AND PROTECTIVE COATINGS



WARN

on your

4-WHEEL DRIVE!

That goes double-more run for your money from your vehicle as well as the hubs. Your 4-wheel drive lives longer, handles easier, costs less to own, is more versatile with Warn Hubs, because they "cut out" the front drive in 2-wheel drive - stop drag, save gears, tires, gas. And Warn Hubs give you the utmost in "selective drive" convenience, dependability and satisfaction too, because they are made that way. Choose Warn Lock-O-Matics for automatic selective drive, or Warn Locking Hubs for the most dependable manual control hubs. You get more for your money either way.





SOILS

The subhead states that this manual is for the design of asphalt pavements; but it nevertheless contains much of value to all engineers. There are two parts: 1) The general classification of soils; and 2) determination of strength values for design of asphalt paving structures. Part 1 covers origin, composition and properties of soil; making a soil survey; the significance of tests for soil materials; the AASHO and the United classification systems; and the FAA method of soil and subgrade classification. Part 2 discusses the California bearing ratio method; the plate bearing method and the Hveem resistance value method. There are a number of appendices describing standard tests. There are 176 pages, plus the appendices, and a number of illustrations. This is Manual Series No. 10, first edition. No price is given and we assume it is available on request to the Asphalt Institute, College Park, Md., or from any of the Institute District offices.

CONCRETE PAVING CONSTRUCTION

This publication of the Highway Research Board contains six papers on concrete pavement construction. One of the papers discusses cost vs mixing time on dual drum pavers; others report on a study of 34-E pavers, on paving equipment adjustments and on construction practices. There are 58 pages; \$1.40 from the Board, 2101 Constitution Ave., Washington 25, D. C.

PUBLIC RELATIONS IN COUNTY ROAD MANAGEMENT

Officials in charge of county road affairs have a responsibility to keep the public informed about their programs and activities. Public relations are discussed in this 16-page booklet as a necessary management tool and as a means of gaining probular understanding of road problems so that citizen support for improvement programs can be developed. It describes some of the

basic techniques of public relations. It differentiates between "internal" public relations geared to the need of road agency employees and "external" public relations for citizens generally. It tells how both types of programs can be established and operated. Copies are \$3.00; National Association of County Engineers, 1001 Connecticut Avenue, N.W., Washington 6, D. C.

CINCINNATI WATER POLLUTION CONTROL

This, the 11th annual report of the Division of Water Pollution Control of Cincinnati, gives useful information on the waste treatment for that city. There is a rather full resume of the bases for charging for treating industrial wastes. Arthur D. Caster is Superintendent of the Division and Offices are at 1600 W. Gest St., Cincinnati 4, Ohio.

ANALYSIS OF GRID STRUCTURES

This 25-page booklet presents a method of analysis for the design of grid structures such as are used for bridge floors, Detailed solutions are given for grillages consisting of two and of three parallel girders and the solution is given for four main girders. The presentation is highly technical. By B. J. Covington, Prof. of Civil Engrg., L.S.U. Bulletin 66, Engineering Experiment Station, L.S. U., Baton Rouge, La. \$1.

EVALUATION OF HIGHWAY IMPROVEMENT IMPACTS

Research findings by 12 economists and engineers indicate that a new highway in or around a community may produce far greater values than the construction process destroys. Roadside enterprises may be adversely affected but changes in land use over a 4 to 8-year period will generally result in increased values. Bulletin 268 has 119 pages and sells for \$2.60. Highway Research Board, 2101 Constitution Ave., Washington 25, D. C.

LANDSLIDE INVESTIGATIONS

The Bureau of Public Roads has published this field handbook on landslides and related phenomena. Prepared primarily for the highway location engineer, the publication should also be of interest to other engineers, geologists, teachers and students. There are 67 pages and 31 excellent illustrations. The handbook is divided into four parts. The introductory section describes geologic processes, rocks and soil types, and geologic structures which pro-

economy

NEW safety

MEW efficiency

ON ROUTE DELIVERIES ALL-NEW Jeep Fleetvan

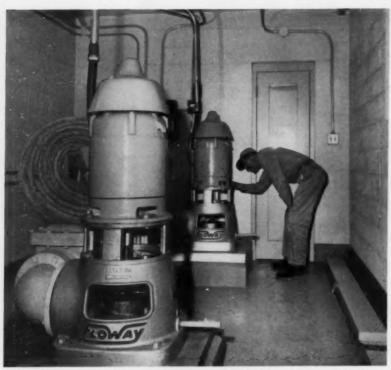


Here's the newest, most economical walk-in delivery van you can buy—the sensational new 'Jeep' Fleetvan. Ideal for multi-stop delivery use! The Fleetvan parks easy. Maneuvers easy. New safety-designed front lets the driver see the road just a short way in front of the bumper. And

the Fleetvan gives top gas economy too. These are just a few of the reasons the U. S. Post Office purchased over 6,000 'Jeep' Fleetvans. For full information on the 'Jeep' Fleetvan write to Mr. R. J. Kreusser, Fleet Sales Manager, Willys Motors, Inc., Toledo 1, Ohio.

Jeep FLEETVAN P®

WILLYS MOTORS, INC., TOLEDO, OHIO. ONE OF THE GROWING KAISER INDUSTRIES



Two 15 hp, 2-stage FloWay verticals easily fit into Mesa Filter Plant 12' x 18' pump house. Engineer: Black & Veatch, Kansas City. Contractor: Southwest Plumbing & Heating, Colorado Springs.

Pumping 500,000 gallons daily with FLOWAY PUMPS

No maintenance trouble in 2 years

To meet the water needs of the Air Force Academy and 2,000,000 tourists yearly, Colorado Springs in 1959 enlarged the capacity of its Mesa Filter Plant from 8,000,000 to 30,000,000 gallons daily, and "after studying all verticals on the market" installed 2 FloWay pumps. These go on and off automatically at prescribed water levels. Says Foreman Al Lafferty, "We've not had a single minute's maintenance trouble since the FloWay pumps were installed."

Your Choice of Verticals or Submersibles. Verticals for deep and shallow wells, sumps, flood control, emergency water supply, etc. Sizes: 15 to 5000 gpm, 0·1000 psi, 800·3600 rpm. Submersibles from 100 to 4000 gpm, 0·1000 psi, 1750 and 3600 rpm. They operate with high efficiency in wells 8" and larger; also are widely used for vertical or horizontal in-line booster service; can be located beneath street, lawn, or floor; operate silently.

FloWay verticals and submersibles comply with AWWA and Hydraulic Institute specifications, are approved by Corps of Engineers for aircraft refueling. They can handle wide fluctuations in head with comparatively low hp—no need to overdesign or overpower...and they save space.

Bring Your Pump Problems to us. For a fresh look at your pumping problems, consult us. Literature and estimates without obligation. Ask us today for name of nearest representative. Fiese & Firstenberger Mfg., Inc., P.O. Box 164, 2494 So. Railroad Ave., Fresno, Calif.



FLOWAY PUMPS

vide the setting for landslides. The second section involves the recognition of phenomena presaging the advent of slide movements, and those characteristic of the landslide itself. The third is devoted to methods of landslide prevention, control, and correction. The fourth section discusses details of mapping and reporting landslides. A glossary of terms is also included. It is available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at 30 cents per copy.

CUMULATIVE INDEX ASCE PUBLICATIONS

Publications of the American Society of Civil Engineers are listed in a new index that gives, by title and author: articles appearing in Civil Engineering from the first issue, October, 1930, through December, 1959; papers in Transactions from 1935 (cut-off date of an earlier index) through 1959; and Proceedings from 1950 through 1959. Most items are listed under more than one heading. American Society of Civil Engineers, United Engineering Center, 345 East 47th Street, New York 17, N.Y. Hard bound, blue cloth, 816 pages; \$20; 50% discount to public and school libraries.

DESIGN CHARTS FOR OPEN-CHANNEL FLOW

The Bureau of Public Roads has published Design Charts for Open-Channel Flow, making generally available a group of excellent hydraulic charts which facilitate the computation of uniform flow in open channels. Some of the charts are also useful in the design of storm drains. The publication is intended as a working tool that should be of considerable service to the designer already familiar with the subject. There are 105 pages and 82 charts which provide direct solution of the Manning equation for uniform flow in open prismatic channels of various cross sections; instructions for using the charts; a table of recommended values of n in the Manning equation; tables of permissible velocities in earth and vegetated channels; instructions for constructing charts similar to those presented; and a nomograph for use in the solution of the Manning equation. Charts are included for rectangular, trapezoidal and triangular channels; grasslined channels; circular pipe channels; pipe-arch channels; and oval concrete pipe channels. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.; 70 cents per copy.

UTILITY TUNNELS with VERSATILITY



On completion of Lo-Hed* tunnel at right, 48" aggregate conveyor system is installed.

132" Lo-Hed® conveyor tunnel being installed for Michigan Limestone Division of United States Steel Corporation at Rogers City.



91 in. x 91 in. Flat Base utility tunnel for New Jersey firm. Note smooth, watertight joints.



Hi-Hed* makes an ideal utility gallery—assures ample head-room in passage way.

A-M PRECAST CONCRETE UNITS CUT INSTALLATION TIME AND COSTS

American-Marietta reinforced precast concrete pipe is available in a variety of shapes. This permits extreme versatility in the design of utility tunnels for carrying steam pipes, gas mains, electrical cables and telephone lines with enough room for workmen to make repairs. In addition to conventional round pipe, A-M offers LO-HED® with greater width under minimum cover; FLAT-BASE with "built-in" walk way; and HI-HED® for minimum vertical load and maximum lateral support under high fills. Find out how much installation time and money A-M Engineers can save on your job with precast pipe. Write today for information and literature.



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101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-3600

NOW...ALLIS-CHALMERS BRINGS YOU



A new combination of full power control—hydraulic steering, braking, and shifting—brings new output capacity and ease of operation to Allis-Chalmers 1¾-yard HD-7G. With a 100-hp turbocharged engine and torque converter drive, there's plenty of smooth, production-boosting power in this outstanding tractor shovel.

Easy! Power steering and power brakes—not only new ease of operation . . . but reduced maintenance and unusually long-life service as well! The reason—steering clutches and brakes run in a complete oil bath. Runs cool, with minimum brake adjustment, no steering clutch adjustment necessary at all!

Economical! Allis-Chalmers 7000 Turbocharged engine—delivers 100 net hp from a combustion system that has established itself as the most efficient in the industry. Controlled turbulence and open chamber combustion design provide a thorough mixing of air and fuel for fast, even, complete combustion...matchless fuel economy.

Fast work cycles with Power-Shift—The 7G combines smooth torque converter performance with single-lever Power-Shift transmission. You *shift on-the-go*—from any forward speed to any reverse speed, with an infinite number of speeds through the entire working range of up to 5.9 mph forward, up to 4.2 mph reverse.

Stable! Most track in its class—With 7-ft, $1\frac{5}{6}$ in. of track on the ground, 62-in. tread, and 15-in. track shoes, the HD-7G has the extra stability to handle heaped loads with speed and safety . . . whatever the job, whatever the terrain.

Smooth! Exclusive Ground-Speed-Control—No need to limit your speed by shifting into lower gears. Set your speed automatically with Ground-Speed-Control. If you want the tractor to run at 2 mph, it moves at that speed with or without load, up to full engine power. There is no speed-up when the load is lightened, no slowdown when it is increased. You get smooth operation throughout the work cycle... top production all day long.

STEP UP YOUR



Your Allis-Chalmers dealer will be glad to arrange a full-scale demonstration on your job at your convenience. Allis-Chalmers Construction Machinery Division, Milwaukee 1, Wisconsin.

POWER FOR A GROWING WORLD







100 HP 1³/₄YD







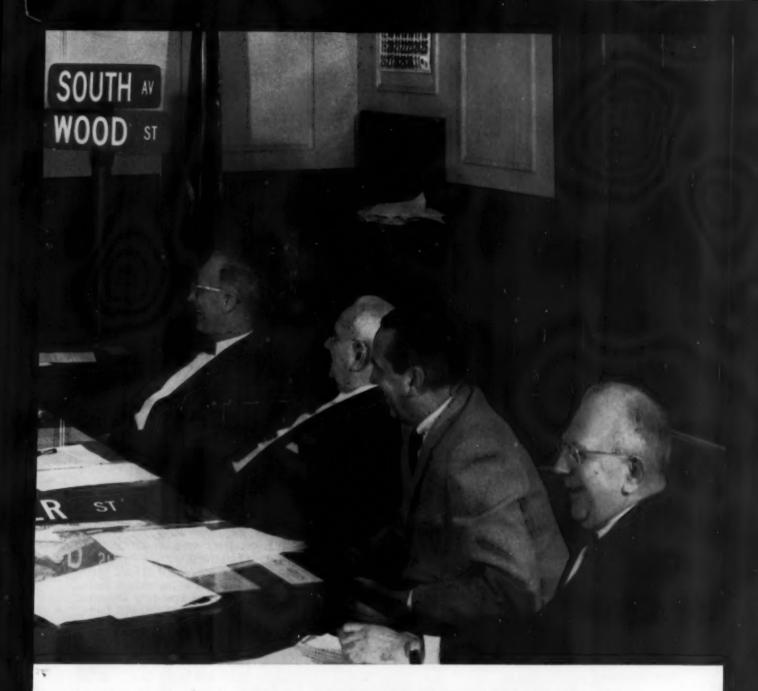
Bill Coslett and Dick Griffith deliver a sales pitch Alcoa didn't pay for!

16 IGN MATERIALS? We've tried 'em all... but nothing works like aluminum!" says William H. Coslett, manager of Traffic Safety and Service Department, Wilkinsburg, Pa.

Borough Manager Richard O. Griffith explained, "At my request, Bill Coslett worked out a complete replacement program for street, stop and safety signs. We compared many prices, many materials, many sources. An experimental program proved aluminum with reflective sheeting to be best for Wilkinsburg's needs."

"We checked other aluminum manufacturers," according to Bill Coslett, "but no one gave us the help Alcoa did. They even came out to our sign shop . . . showed us how to use and work with aluminum.

"Our aluminum street and stop signs are light in weight—yet plenty strong! They're easier to maintain because they'll never rust. Aluminum keeps its sharp lines and good looks for years," Mr. Coslett added.



Clarence H. Schreiber, Wilkinsburg's Chief of Police, discusses the added safety value of new Alcoa Aluminum Stop Signs with Burgess H. R. Rowland. In the background, maintenance crewman William Rosenberry installs new, easy-toread Alcoa Aluminum street name signs.



Council approval was unanimous for aluminum!

PS—This is a true story. In the fall of 1959, the Borough Council of Wilkinsburg decided on Alcoa® Aluminum for their street and stop signs. The replacement program is now almost complete. And Wilkinsburg is already saving money due to reduced maintenance.

Call your nearest Alcoa sales office and learn how your community can stretch tax dollars with Alcoa Aluminum Street and Stop Signs, and at the same time qualify for the big FREE "Welcome to Your Town" sign. Or write: Aluminum Company of America, 897-L Alcoa Building, Pittsburgh 19, Pa.



HIGHWAY PRODUCTS



NEW '62 FORD TRUCKS

Get full-time economy that only starts with Ford's low price!

Meet the trucks that make saving money a full-time business—new Ford Trucks for '62!

In a selection of over 600 models there's a truck that's right for your job, whatever your job... trucks that you can buy and operate at lower cost... trucks that can save you money mile after mile, load after load, year after year!

They save on price. They save on gas and oil. They save on tires and on maintenance—wherever there's a way to save! The full record of Ford economy, covering three years of independent tests, is detailed in Ford's Certified Economy Reports. See your Ford Dealer now. Check out the facts, work out a deal, and drive out a truck that saves money . . . full time!

FORD TRUCKS COST LESS

SAVE NOW ... SAVE FROM NOW ON!



ECONOMICAL HEAVY DUTY V-8's

with 292-, 302- and 332-cu. in. displacement give you tailored-to-the-job economy at much lower prices than you would expect in trucks with engines of this size. Stress-relieved cylinder heads, aluminum alloy pistons and sodium-cooled exhaust valves are but a few of the heavy-duty features you get with these engines.







econoline — All-Round Economy Leader — and low price is only the start! Certified tests show this pickup may save \$100 on gas, oil, tires and license over your present conventional pickup every 16,000 miles you drive.



AMERICA'S MOST POPULAR VAN—and small wonder! Econoline savings start with a price far under any popular ½-ton conventional panel on the market! And they continue saving every day—certified tests have shown that in 16,000 miles, savings in operating costs compared to the conventional panel you may now own could top \$100! Big 4-ft. doors rear and curbside plus 204 cu. ft. of loadspace, and a floor that's flat the full length, mean easy cargo handling.

PROVEN 262-CU. IN. BIG SIX FOR FORD MEDIUMS includes more heavy-duty engine features than any other Six of its size. Never before such long-term durability, reliability, and economy at so low a price.



fast, trouble-free water service connections with the MUELLER, B-100 MACHINE

and mueller corporation stops

designed for
ease of operation—
perfect
alignment—
accurate,
watertight
connections.

Three bearing design of boring bar assembly assures perfect alignment with the main in all phases of operation. Absolute accuracy, longer tool life and ease of operation are dependable benefits of this engineering feature.

Offset flop valve design provides trouble-free means of isolating full water pressure in lower chamber.

Matched Tool and Corporation Stop design allows easy, accurate fit and alignment in attaching to the boring bar. For over 90 years, the MUELLER Tapping Machine, MUELLER Tapping Machine Tools and the line of MUELLER Corporation Stops have been precisely matched in design and quality. This matched working team has given the Water Works industry its most dependable and economical service connections.

Double Chamber design permits the service connection to be made under full water pressure in two separate operations—first the main is drilled and tapped; second, the corporation stop is inserted in the threaded hole in the main. This is accomplished without interrupting water service and with no loss of water.

Double Chamber design permits the machine to be handled in lightweight sections. The base section of the machine, which contains the valve chamber, is rigidly attached to the main. The top section, with the boring bar assembly, is removable. This gives complete flexibility of operation, such as allowing the tool or stop to be removed at any time during the operation, or permitting the extraction and replacement of old corporation stops.

design matched and precisely

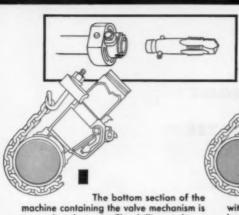
to work together.

Corporation Stop Thread design is perfectly mated to tapping tool thread to insure accurate, watertight connection to the main.

For additional information, consult your Mueller representative or write direct.

the inside story . . .

This time-proven method of drilling and tapping the main and inserting the stop under pressure guarantees trouble-free water service connections.

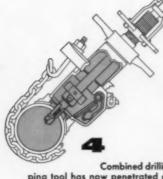


The bottom section of the machine containing the valve mechanism is secured to the main. The drilling and tapping tool is attached to the top section with boring bar assembly.

Top section of machine, with drilling and tapping tool attached to boring bar, is secured to base section. Flop valve has been opened and boring bar lowered to drilling position.

Drill has penetrated pipe wall—full water pressure is being controlled within entire body of machine. B-100 Machine can be either hand or power operated.



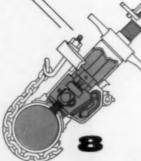


Combined drilling and tapping tool has now penetrated deeper into the main to cut accurate, matching threads for insertion of corporation stop. Boring bar has been raised above the lower body chamber. Flop valve is closed to confine water pressure to lower chamber. Entire boring bar assembly can now be removed without loss of water.

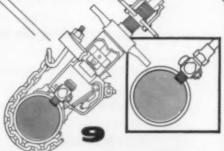
Boring bar assembly has now been removed from lower section of machine. At this point, the matching corporation stop is attached to the boring bar, replacing the drilling and tapping tool. Boring bar assembly can now be repositioned on machine without disturbing flop valve or water pressure.



The boring bar assembly with stop attached is replaced on base section of machine. The precise alignment with the tapped hole is again assured for the insertion operation.



Boring bar assembly is lowered—matching threads of corporation stop and tapped hole allow easy, troublefree insertion into main.



Watertight service connection to main completed. Machine can be removed and service piping attached to closed corporation stop. Stop is then opened to activate water service.

MUELLER CO.



DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles In Canada: Mueller, Limited; Sarnia, Ontario

WHAT WILL YOU INSIST ON IN YOUR NEXT LOADER?

- machine availability
- low, long-term cost
- high productive capacity
- simple, easy operation
- fast, easy servicing
- high trade-in value
- reliable dealer service





This 1% cubic yard 955H, owned by Polk County, Georgia, can load a 5 yard truck in less than 60 seconds. It could easily truck-load 2200 tons in an 8-hour shift. District Foreman John Davis says the 100 HP 955 is the best rig that he's ever had anything to do with. "And I've been in the business for years," he says. "The 955 loads easily and has plenty of power. We do a lot of digging with It." Like its brothers, the 977 and 933, the 955 has lifetime-lubricated rollers, a rugged undercarriage and a dependable Cat-built diesel engine.



This 2½ cubic yard 977H, owned by Anderson County, South Carolina, is being used to build \$1,500,000 of new roads, replacing those closed by the Hartwell Dam in the Barkas Creek section. "Power shift really pays off for us," says John Ashley, County Supervisor, "because we generally don't have a crew with a lot of equipment experience. Our new men get good production out of the 977 in only a few days. We've found out that it's an easy mechine to keep in good operating condition, too. That helps stretch our budget."

IF YOU'VE CHECKED 3 OR MORE ESSENTIALS...YOUR BEST BUY IS A CAT LOADER

Matter of fact, if you've checked only one a Cat loader is the answer. Low, long-term cost—so important when you're investing public funds—is an established Caterpillar fact, a record earned by years of low-cost, high-production performance on city, county and private contract jobs. It's a record based on thousands of individual machine cost sheets and detailed performance reports.

On jump-and-run jobs or on 2000-4000 tons/ day quarry or excavation assignments, Cat loaders are ready to put in a full shift every day.

There are 3 rugged Traxcavator track-type loaders: the big 2½ yard 977H, the 1¾ yard 955H and the 1¼ yard 933. The high-production 977 and 955 are equipped with Caterpillar power shift transmissions for instant changes of speed and direction at the easy flick of a lever. Add this to Caterpillar's automatic bucket controls, live-action hydraulics and increased horsepower and you've got the smoothest, fastest-working loaders available.

Functional design and unitized construction

make Traxcavator Loaders easy to service; they bounce back on the job quickly...and years from now, when you're ready to trade-up to a new model, they'll bring a premium trade-in price.

If you haven't checked that last box \square reliable dealer service, think about it again. No matter how expert your repair crews are, no matter how reliable your equipment, the services of an alert, responsible dealer are invaluable. Look over your Cat Dealer's facilities. His parts inventories and service bays could save your taxpayers' money.

Insist on getting what you need in your next loader—and to be sure, see your Caterpillar Dealer. Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR



EQUIPMENT AND MATERIALS

For Your Public Works Program

NEW LISTINGS

New-Type Equipment for Off-Road Hauling and Towing

429. One-sheet circular tells all, with illustrations, specifications and mechanical story on the Cushman Haulster. Discusses jobs for which it is specifically suited. Yours may be among them. Address Cushman Motors, Lincoln, Neb., or check our card-number.

New Activated Sludge Treatment Equipment Developments



430. A new 4-page brochure, Bulletin No. 7320, describing four recent equipment and flowsheet developments for the activated sludge waste treatment process. has been issued by Dorr-Oliver Inc., Stamford, Conn. The four Dorr-Oliver developments described in this bulletin are the D-O INKA Aeration System, the D-O Aerator, the RSp. Clarifier, and the Filter. Check the reply card for your copy.

New Fast Tractor Shovel

433. Specification bulletin explains features, including choice of two diesel engine options; also lists standard and optional equipment for this newest tractor shovel. Address The Yale & Towne Mfg. Co., Trojan Div., Batavia, N. Y.

Emulsified Asphalt Pavement Technical Bulletin

435. Special advantages of emulsified asphalt are outlined in 24-page technical bulletin, with on-the-job photographs illustrating the material in use and showing the texture of pavement surface attained. Much useful tabular data, too. Write American Bitmuls & Asphalt Co., 320 Market St., San Francisco 20, Calif.

Residual Chlorine Analyzer

436. Attractive 6-page brochure describes the analyzer unit and null balance potentiometer that form complete Anachlor equipment. Its operation also outlined in detail. Get your copy of this new Catalog 17B2200 from Fischer & Porter Co., 995 Jacksonville Road, Warminster, Pa., or check our card-number.

Masonry Drilling Machine

437. . . newly-described in 4-page well illustrated bulletin. Machine designed to drill holes 1" to 6½". Many attractive features that will interest you. Address Sprague & Henwood, Diamond Masonry Drilling Div., Scranton, Pa.

Spreaders for Ice Control

439. Set of bulletins offered that cover all aspects of equipment for salt, sand, calcium chloride and cinder spreading. Most timely right now. For yours, write Baughman Mfg. Co., Inc., Jerseyville, Ill., or check our card.

New and Beautiful 16-page Brochure

441. Describing and picturing in colors factory-built sewage lift stations and sewage treatment plants. Look in your 1961 SEWERAGE MANUAL and Catalog File for yours, bound into Chapter 9. Otherwise, write for Bulletin 50 to Smith & Loveless Div., Union Tank Car Co., Dept. 40, Lenexa, Kansas, or check our card-number.

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

Special Utility Truck Bodies

442. New brochures on these may be just what you are looking for. To be sure you have all the valuable facts contained in them, write Holan Corp., 4100 W. 150th St., Cleveland 35, Ohio, or check number on our card.

How to Prevent Corrosion and Deterioration in Sewage Treatment Plants

443. Valuable, illustrated information on this live subject, with applications and specifications, is packed into this helpful booklet. To get yours, write for Bitumastic Protective Coating Guide to Koppers Co., Inc., Tar Products Div., Pittsburgh 19, Pa., or check our card-number.

The Well That Never Runs Dry

444. Is the attractive title of a very attractive brochure on the ocean as a source of fresh water supply after de-salting. Of interest, too, in inland areas with brackish waters. For yours write Fairbanks. Morse & Co., 100 Electra Lane, Yonkers, N. Y., or use our card.

Telemetering by Time Duration Impulse Signals

445. Described in Specification Data bulletins just released. Tells how the Differential, Pressure or other process variable is converted into electrical time duration signal. Write for your set to B-I-F Industries, Providence, R. I.

Design Manual on Remote Control for Valves

449. New 28-page design book, announced as essential for any engineer contemplating the use of remote control for valves. Cites some unusual features and uses. For yours write for Manual 618 to Stow Mfg. Co., 290 Shear St., Binghamton, N. Y., or check number on our card.

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Laboratory Chemicals Apparatus

447. 74-page catalog describes and lists com-plete equipment; also gives procedures for water analysis and lists chemicals. For your copy write Hach Co., Ames, Iowa, or just check our

Mercury Street Lighting in Philadelphia

448. Described in new 16-page booklet showing how this major city uses mercury luminaires to re-light its streets, expressways, parking lots and interchanges. Write for booklet B-8230 to Westinghouse Lighting Div., Edgewater Park, Cleveland, Ohio, or use our card.

Warn Hubs for Selective Drive

450. Bulletin tells of their advantages for 4-wheel drive vehicles. Describes how you can switch to and from 2 and 4-wheel drive through medium of these hubs. Write for Catalog 60W to Warn Mfg. Co., Inc., Riverton Box 6064, Seattle 88, Wash., or use our card.

Bonnetless Knife Gate Valves

451. Are clearly described and portrayed in 8-page brochure on this new rubber seated gate valve. Lists features, materials, dimensions, actuators, and places where most useful. Write for Bulletin 302 to DeZurik Corporation, Sartell, Minn., or circle the number on our card.

Complete Line of **Euclid Road Equipment**

453. Now described and illustrated in one pocket-size booklet that will be handy out on the job, too. Contains condensed specifications. Just write Advertising Dept., Euclid Division, Hudson, Ohio, or use our card.

New Line of

Sewage Treatment Chemicals

454. 4-page bulletin includes descriptions of a variety of treatment chemicals for use in sewage treatment plants, waste disposal facilities in private subdivisions, industries and institutions. Address Robert H. Brunner, Adv. Mgr., Brulin & Co., 2939-45 Columbia Ave., Indianapolis 7, Ind., or circle number on our card.

"Proof Book" on Pipe Performance

436. Gives facts and figures for comparison on Bermico fibre pipe in sewer service and for carrying low-pressure liquids underground. Actual case histories feature it. Ask for yours from Bermico Division, Brown Co., Berlin, N. H., or ring the number on our card.

New Refuse Loader-Packer with 7 Advantages

457. Described and pictured clearly and concisely in brochure outlining 7 advantages listed as exclusive. Write for yours to Dow Packer Corp., 115 S. Main St., Fairview, Okla.

Slip Resistant Steel Flooring

458. Handy information for engineers in an 8-page brochure on this safety flooring material. Weights, sizes, safe loads and fabricating and installation instructions are included. Ask for Inland 4-Way Safety Plate Bulletin of Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill., or check our card-number.

New Type Rust Remover

464. Claimed better than wire-brushing, blast or flame-cleaning, 4-page folder tells how it gets down to bare metal by chemical action. Get your copy from Sloan Chemicals, Inc., Caxton Bldg., Cleveland 15, Ohio, or circle number on our card.

ACID-RESISTANT, WATER-TIGHT, QUICK-COUPLING JOINTS for straight and offset concrete sewer pipe

with TYLOX®

"C" SERIES flexible GASKETS

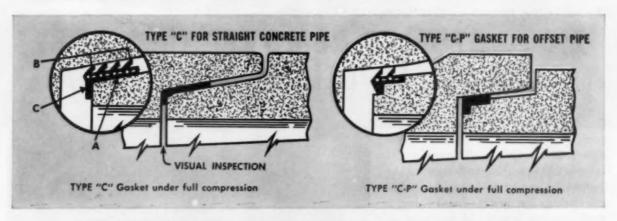


Sanitary Engineers can take advantage of the matchless efficiency of TYLOX Flexible Gaskets for coupling any concrete pipe sewer they design ... because there's a specially designed TYLOX cross-section for any type of concrete pipe!

Type "C" Gaskets for straight, and type "C-P" Gaskets for offset pipe, provide the same high performance features you are accustomed to in famous Type "A" Gaskets . . . PLUS a visual inspection feature made possible by a flange which overhangs the edge of the pipe tongue, or tongue offset, according to the type of pipe. On pipe large enough to admit workmen, proof

of correct gasket positioning can be obtained by noting whether the inspection flange is evenly seated around the entire circumference of the joint. The larger the pipe, the more important this visual inspection feature becomes.

TYLOX "C" Series Gaskets are made for all pipe sizes, handle head pressures up to 50-feet, and are available in either rubber or neoprene. They may be applied to pipe at the pipe manufacturer's plant, or at the job site. Like all TYLOX Gaskets, they are immune to sewerage and industrial waste acids, and keep joints water-tight for the life of the pipe itself.



"C" Series TYLOX Gaskets consist of base A; sealing fins B; and inspection flange C. In addition to providing the inspection feature, the "locking" effect of the flange holds Gasket in true position as pipe is coupled. Design of the sealing fins is such that horizontal endthrust forces causing "kickback" in some couplings, are eliminated in Tylox "C" Series Gaskets, assuring full seating and true alignment of pipe.





Fully illustrated literature contains engineering data and installation information. Get it for your files. See why there are more TYLOX Gaskers specified for low head service than all other types of gas-kers combined. Specify TYLOX Flexible Gaskets for jointing your waste disposal pipe lines.

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To order these helpful booklets check the reply card opposite page 34.

NEW LISTINGS (Cont.)

Budget-Priced White Printer

460. . . . is described and illustrated in 4-page bulletin. Designed for use in drafting rooms of engineering departments to give high quality prints from any translucent original. Ask for Bulletin 400, Ozalid Div., General Aniline & Film Corp., 531 Corliss Lane, Johnson City, N. Y., or check our card-number.

Instant Power, Any Place

466. Portable electric power when and where you want it. A 4-page folder tells all in small compass. Get your copy on the Zeus unit from Pesco Products Div., Borg-Warner Corp., 24700 N. Miles Rd., Bedford, Ohio, or circle our card-number.

The Brush Chipper With Ten Exclusive Advantages

447. Brush chipper features worth investigation are described in Mitts & Merrill Catalog 460. Advantages include ability to cut two sizes of chips. Catalog illustrates uses and gives specifications of "Beaver" Chipper. For your copy, write Mitts & Merrill, 1009 S. Water St., Saginaw, Mich., or check reply card.

How to Hold That Water

474. Is the subject of new folder on prevention of losing it into the ground from reservoirs, sewage channels, waste treatment pools and aerating basins. Write for Careymat Liner folder to The Philip Carey Mfg. Co., Cincinnati 15, Ohio, or check number on our card.

New '62 Motor Trucks

476. Are beautifully illustrated and thoroughly described in this new multi-color brochure on the Chevrolet trucks of all types for 1962. Yours now for the asking, of Chevrolet Division, General Motors, Detroit 2, Mich., or use our card.

STREET LIGHTING AND

Aluminum Traffic Control Devices

32. Is title of 24-page booklet covering every such device made of aluminum, from signs and sign blanks to panels, overbead structures and paint. Full specifications. For yours, just write Aluminum Co. of America, Alcoa Bidg., Pittsburgh 19, Pa., or use reply card.

Steel and Aluminum Lighting Poles for Streets and Highways

74. Standard designs, assembly details, suggested pole sizes and base construction details are some of the information offered in Bulletin LS-29 (Steel) and Bulletin LS-30 (Aluminum). Check the reply card or write The Union Metal Mfg. Co., 1432 Maple Ave., NE., Canton S, Ohio, for details covering the latest Monotube pole designs for modern streets and highwars.

Latest Data on Davits for Lighting Standards

77. Is in a just-issued 12-page catalog. In it are classified the various davits available by mounting height, appearance and arm extension. Ask for this booklet by name from Pfaff & Kendall, 84 Foundry St., Newark 5, N. J., or circle our card-number.

Lighting Standards for Every Outdoor Lighting Requirement

284. Complete design details, typical installation photos and how Stress-Spun standards are made are covered in this valuable guide. Check the reply card or write to the American Concrete Corp., 5092 North Kimberly Ave., Chicago 30, Ill., for Catalog 400.

Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, and hand-propelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy reply card.

Complete Line of Traffic Signals and Control Equipment

380. A full line of traffic signal and control equipment is covered in the comprehensive catalog of Econolite Corp., 8900 Bellanca Ave., Los Angeles 45, Calif. Wide choice of components offers economy and flexibility to suit future requirements. For more information write direct to Econolite or use the convenient inquiry card.

BUSINESS ADMINISTRATION

If You are Considering a trustee for a Bond Issue Check with Chase Manhattan

236. For details on how a bank serves as trustee for bond issues for any municipal or governmental unit, write The Chase Manhattan Bank, 1 Chase Manhattan Plaza, New York 15, N. Y.

Monthly Time and Cost Record Book

249. To assist owners in determining the cost of owning and operating equipment Cateriellar Tractor Co., News Service, Peoria, Ill., has prepared a 24-page monthly time and cost record book. Twelve sets of pages are included on which to record day by day machine expenses for an entire year. Check the reply eard for your copy.

Kansas City, Mo. Buys 5 New Pow-R-Stump Cutters . . .

"2,000 STUMPS REMOVED IN 30 DAYS AT A COST FAR BELOW OUR ESTIMATE"

"As we've used a Vermeer Pow-R-Stump Cutter for 5 years, we knew what to expect when we recently ordered 5 new Pow-R-Stump Cutters. The new model is smoother operating and seems to cut faster than our original equipment. We are working the new machines 6 days a week, weather permitting, and have removed approximately 2,000 stumps in the last 30 days. The cost of removal including amortization, overhead, service parts and labor is far below the \$5.00 per stump we had estimated."

/s/ Herbert W. Brackney, Landscape Architect, Kansas City, Missouri

5 MODELS AVAILABLE TO FIT EVERY STUMP CUTTING NEED

Over 800 cities are now using Vermeer Pow-R-Stump Cutters to rip out ugly stumps...in minutes! No back-breaking labor. It's the modern, economical way to remove stumps. Write for complete information, low price and FREE demonstration.



Photo above shows new Model 10 Vermeer Pow-R-Stump Cutters recently purchased by Kansas City, Missouri, Park Commission.

Send complete descriptive litera Vermeer Pow-R-Stump Cutters.	ature and prices on the complete line of
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"\$25,000 PER YEAR SAVED!"---City "A"

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RESULTING IN IMPROVED SERVICE AND CUSTOMER RELATIONS!"---City "C"



"AMORTIZED IN 26 MONTHS!"---City "B"

Dependable Transistorized B-I-F Supervisory Control Cuts Operating Costs of Widespread Systems

"\$25,000 per year saved" and "Amortized in 2 years and 2 months" . . . typical testimonials received from the many municipalities using B-I-F supervisory control systems . . . names upon request. Systems range in size from relatively compact layouts to operations spread over 100 square miles with more than 200 stations, valves and similar functions

One operator, at a centralized control panel, knows instantly when irregularities occur at distant points . . . takes immediate corrective action. Report-back verifies that a valve is open or closed, that a particular pump has started or stopped, or that . . . through visual indication . . . the desired function is correctly recorded.

B-I-F Supervisory Control Systems employ many advanced, but performance-proved techniques to provide centralized control at low operating cost. Dependable, safe system reduces equipment costs, operating costs . . . provides for low cost system expansion.

Request Bulletin 0240.20-3 for complete details. Write B-I-F Industries Inc., 356 Harris Ave., Providence 1, R. I.



Industries

A DIVISION OF THE NEW YORK AIR BRAKE COMPANY



METERS . FEEDERS . CONTROLS / CONTINUOUS PROCESS ENGINEERING

To order these helpful booklets check the reply card opposite page 34.

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

42. The wide, thin sattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for ful details on their spreader and table of material application rates. Use reply card or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs N. Y.

Engineering Data on Truck Mounted Snow Plows

116. Trip cutting edges, one-way plows, push frames and reversible snow plow mold-boards are covered in literature from Flink Co., Streator, Ill. Check the reply card.

Snow Plaws and Road Scrapers

128. Here is a ten-page illustrated booklet that no highway or street maintenance engineer or official will want to enter next winter without. Your copy, by the above title, awaits you free on request of Root Spring Scraper Co., Kalamazoo, Mich., or use our card.

Bare Pavement Maintenance With Sterling Rock Salt

158. Handbook is designed for road maintenance men who are responsible for safe winter pavements; and is a safe-roads fact book about a modern snow and ice removal program. Check the reply card or write International Salt Ca-Inc., Clarke Summit, Pa.

Snow Plews For Every Need

294. Frink snow plows are designed to meet snow removal needs at airports, parking lots and streets and highways. They consist of four basic types with models to fit trucks 1½ to 12 tons. For complete data write Frink Sno-Plows, Inc., Clayton, N.Y.

Save on Winter Ice Control Cost

237. . . with the faster-working salt described in this new Bulletin B-1159S. Tells want this salt will do and why, and where to get it. Also the bonus you get from using salt for summer road stabilization projects, Address Morton Salt Co., Industrial Div., 110 N. Wacker Drive, Chicago 6, Ill., or use our eard.

No Idle Trucks with these Spreaders

397. New 8-page catalog gives features, specifications, users' statements on the Fox Mountable spreaders, equally good for sand, cinders, chips, salt, calcium chloride. Designed for one-man operation and year-round use. Wide widths and high speeds. Mounts or demounts in 15 minutes. Write Fox River Tractor Co., Box 469, Appleton, Wisc., or check our card number.

How to Make Icy Surfaces Safe

455. A bulletin on how calcium chloride works in ice control and direction for its use has been made available by Wyandotte Chemicals Corp., Michigan Alkali Division, Wyandotte, Michigan, Other uses of calcium chloride are fully outlined.

Plan for Bare Pavements

All Winter

470. Helpful folders on clear pavement winter maintenance by use of chemical mixtures are offered by Solvay Process Division, Allied Chemical Corp., 61 Broadway, New York 6, N. Y. Circle number on reply card.

Snow Plows For Snow Control

539. V-type one-way and reversible plows with hydraulic hoist and having a plowing width of up to 9½ ft. are described in literature from Gledhill Road Machinery Co., Galion, Ohio. For models, specifications and features check the reply card.

Automatically Signals Ice or Snow on Pavement Ahead

329. Enables motorists to know what is ahead before they start to skid. Applies especially bridge surfaces. For full details, specifications and special applications, write Kar-Trol Signal Co., 12739 S. Main St., Houston 35, Texas, or use the reply card.

Formulation for use in Thermal Snow and Ice Removal Systems

493. The properties and advantages of Dowthern SR-1, a heat transfer fluid, and typical installation layouts are covered in catalog available from The Dow Chemical Co., Midland, Mich.

WEED CONTROL

Weed Control Deserves a Program

45. You can get a lot of valuable guidance on how to use two weed control berbicides available as wettable powders or granules to give season-long control. Get descriptive brochure GAC 630. Address Geigy Agricultural Chemicals Div., Saw Mill River Road, Ardsley, N. Y., or ring number on our card.

Weed and Brush Killer Cartoon Book

253. A novel "Western" approach is used in a cartoon-style booklet to dramatize herbicides for brush control along rights-of-way and mixed brush and weeds. Write for "Diamond Deputies." You and your kids will both profit from it. Address Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio, or use our reply card.



for Fast, Efficient Spreading of Bulk Chemicals for snow and ice control.

This is your most Economical unit. You save: by lower initial cost; by using less material; by lower maintenance costs.

"Scotchman" Spreader, Model SS7V3, gives you one-man, cab control. Blows salt on in wide, "bird-shot" melting pattern . . . you use less salt. The dump body mounted "Watchman Hopper" . . . either 3 cu. yd. or 5 cu. yd. . gravity-feeds salt to spreader, without running with elevated body

TARRANT MFG. CO.

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... hauls, unloads, re-loads it, too ... with Trailevator, the amazing hydraulic elevating trailer that lowers to ground level for easy, one-man loading ... lifts its own load in seconds! Parks, golf courses, colleges, eemeteries ... if maintaining grounds is your responsibility, find out how you can get more jobs done in less time, at less cost ... with Trailevator.

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Trailevator



OWNER: Mayfair Farms Construction Corporation, Passaic, N. J. PROJECT: Penn Square Development, Yardley, Pa. ENGINEER: W. S. Erwin & Associates, Fairless Hills, Pa. MANHOLE: 48" Diameter Precast Reinforced Concrete Manhole, Riser and Top.

U. S. precast manholes reduce installation and sewage treatment costs!

Reinforced concrete, precast manholes by United States Concrete Pipe Company provide economical installation and long, trouble-free service life. U. S. precast manholes are ready to place in position immediately following arrival at job site. Riser sections are available in increments of 1, 2, 3 and 4 foot lengths. Tops are supplied in flat, off-set or cone design.

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For fast, tight construction, specify U. S. precast concrete manholes. Get complete information on United States Concrete Pipe sewage handling systems by calling or writing the United States office in your vicinity.



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Sales Offices: Baltimore • Pittsburgh • Philadelphia • Cincinnati • Ft. Lauderdale • Ocala • Kalamazoo



A sad tale's best for winter. -Shakespeare

Stales all right, but he can't top what happened to me last winter. The setting was perfect. A large snow and calcium choride were all I needed to win a steak dinner from George Daley, the new highway engineer. George bet that the county's stockpile of salt would keep the roads clear. Naturally, I said it wouldn't.

After breaking through the ice barrier in front of my garage with my last bag of calcium chloride, I set off with visions of a juicy steak dinner. However, I was surprised to find the roads practically clear. The steak began to fade.

George was disgustingly bright and cheerful when I finally dug my way through his snow-clogged parking lot. "Hey, Sproule, have any trouble driv-ing?" he asked. I had to admit the roads were clear. "Well, I'll take my steak rare," he said. "You know, Sproule, I forgot to tell you that during your vacation last summer, the county bought up a supply of the calcium chloride you're always pushing to mix with their salt. By the way I hope you have a bag right now, because everyone gets stuck in the parking lot."

All I can say is, don't you get stuck without Wyandotte Calcium Chloride around. It helps keep abrasive storage piles free-flowing and works at sub-zero temperatures. Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.

WYANDOTTE CHEMICALS



MICHIGAN ALKALI DIVISION HEADQUARTERS FOR CALCIUM CHLORIDE

To order these booklets check card opposite page 34.

STREETS AND HIGHWAYS

Useful Attachments for "Payloader" Tractor Shovels

95. Increased versatility for Hough "Pay-loader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hy-draulic backhoe, back-filler blade. pickup sweeper, scarifier teeth, winches, etc.

Prestressed Concrete Information

97. A complete profusely illustrated catalog covering use of prestressed concrete as a construction material for bridges, pressure pipe, tanks, and many other public works applications. Gives specifying data, too. Address American Steel & Wire Div., U. S. Steel Corp., Rockefeller Bldg., Cleveland 13, Ohio.

Vacuum-A New Method of Pavement

103. New folder describes a compact, maneuverable pavement cleaner using only vacuum-air blast air. Sweeps path 6½ feet wide. Complete details available from Tarrant Mfs. Co., 28 Jumel Place, Saratoga Springs, N. Y., or just check our card-number.

"Low Bid? Best Buy?"

144. Don't miss this penetrating analysis of the "Low Bid" fallacy, put out in tabloid form with some thought-provoking case histories in-cluded. Have this presentation of bid facts be-fore your next letting. Ask for Form D111 from Caterpillar Tractor Co., Peoria, Ill.

To Sweep a Better Street for Less

162. Find out about what Prostran can do to make your street sweeper brooms last longer, cut "down-time" and lower your cost per sweeping mile. A folder, with sample polypropylene filament is yours for the asking from E. B. & A. C. Whiting Co., Burlington, Vermont.

Don't Haul and Burn Brush, Dispose of It on the Spot

196. How you can do this the easiest way with Fitchburg Chippers is the theme of 16-page illustrated catalog that can save you work and grief. Gives experiences of others and describes simple mounting on truck body or on trailer, tractor or Jeep. Write Fitchburg Engineering Corp., Fitchburg, Mass., or just use reply card.

Illustrated Specifications on Brush and Limb Disposal

222. A new booklet on the modern approach to the brush problem shows how an Asplundh chipper reduces bulky branches and brush trimmings to chip size for mulch or easy removal. Write Asslundh Chipper Company, 501 York Road, Jenkintown, Pa.

A Tape Measure on Wheels

272. You walk with it and it clocks off feet and inches like an automobile speedometer. Circular describing its many public works uses and full details available on request from B. G. Reilly Co., Box 231, North Scituate, R. I. or by using our reply card.

"Guide to Cutting Truck Costs"

348. This is title of a 96-page book to aid truck owners in obtaining improved service and performance from any truck of any make or model. Covers everything from insurance to maximum gas mileage. Get your free copy from Truck Marketing Dept., Ford Motor Co., P. O. Box 608, Dearborn, Mich., or use our reply card.

Everybody Else May Have Automotive Battery Problems-

401. . . . except those who have read the Leece-Neville folders on their alternator-generator systems, and then done something about it. Have less trouble by taking the trouble to write for these bulletins, to The Leece-Neville Co., 1374 East 51st St., Cleveland 3, Ohio, or ring the card-number.

Bitumuls Paving Handbook Full of Useful Data

Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and water-proofing. You can have a copy by checking the reply card. American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Calif.

Manual on

Structural Shapes

479. This 80-page catalog has a wealth of information, engineering data, and tables for engineers, architects and designers of steel buildings and other steel structures. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for your copy.

What Henry Didn't Know About Tractors and What It Cost Him

513. This is the theme of a "comic book" that has as much sound information and sense in it as it has laughs. And there are plenty of both. Moral: Ignorance is not bliss when it is costing the tractor owner money. Your men will appreciate it. For copies, write for "Henry's Crawler," to Advertising Dept., J. I. Case Co., Racine, Wis. or circle our reply card.

For Better Work All Over Town

525. Put a Bantam in your life. On trenching, excavating, street and highway work this handy versatile crane-excavator obviates using larger equipment in many cases. Saves time and dollars. Get descriptive literature from Schield Bantam Ca., 301 Park St., Waverly, Iowa or circle card-number.

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540. Including tractor shovels, dozers, scrapers, loggers and special equipment models and features illustrated and described in attractive brochure available from Clark Equipment Co., Construction Machinery Div., Benton Harbor, Mich, Or just check number on our card for us to order for you.

Tough Mowing Jobs Made Easy

546. . . with the new extra-duty Jacobsen Ram Rotary mower. Cuts smooth on rough terrain. For full description of its versatility write for literature now. Address Jacobsen Mfg. Co., Dept. PW, Racine, Wis., or check the inquiry card.

For Soil Sampling and Pavement Coring

576. There's an easier way to do both with Acker equipment. Bulletin 26-R describes a kit containing 12 different soil sampling tools. Bulletin 40-R tells about the All-Purpose auger for all types of sub-surface exploration. Bulletin 700-R illustrates the Acker Shear Test Kit for in-place shear tests in soft areas. Name the ones you want. Acker Drill Company, Inc., Box 830, Scranton, Pa., or check our card.

Complete Line of **Asphalt Patching Mixers**

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConnaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Design of Concrete **Pavements For City Streets**

d37. Sections covered in this manual are classes of streets as to traffic, quality of concrete, working stress and safety factor, types of pavement design, design procedure, jointing of municipal pavements and use of distributed steel. Check the reply card or write Portland Cement Association, 33 West Grand Ave., Chieago 10, Ill.

Now, a "Snap-Mount" Backhoe

430. Attaches or detaches in 30 seconds, without tools. This is only one of the advantages of this equipment as described in 6-page folder. Write for booklet on Model 110 Hopto, to the Warner & Swasey Co., Badger Div., Winona, Minn., or circle above card number.



Increase roadway and runway safety with Transite Underdrain Pipe

Eliminate the contributing causes of sags, holes and similar hazards to under-wheel safety with perforated Transite® Underdrain Pipe. Its superior performance in groundwater control has been proved in many county, state and federal installations.

Transite Underdrain has an exceptional weight-tostrength ratio. The coupling, used to form the joints, assures a flexible yet reliably joined system. This, combined with long (10' and 13') lengths, keeps the pipe aligned and allows the line to ride with normal soil movement without disturbance to the system. Transite's smooth inner surface and low coefficient of friction assist the flow of water and reduce the opportunity for water-borne silt to build up on the invert. Thus, the accurately sized, drilled and located perforations can perform their function of letting groundwater into the line at a maximum flow rate.

For full details, send for data sheet TR-246. Write to Johns-Manville, Box 362, PW-11. New York 16, N. Y. In Canada: Port Credit, Ontario. Cable address: Johnmanvil.



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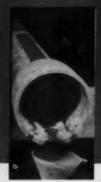
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CONCRETE



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CLAY

Unretouched photos
show corrosion
damage caused
by the flow
of acid solution.

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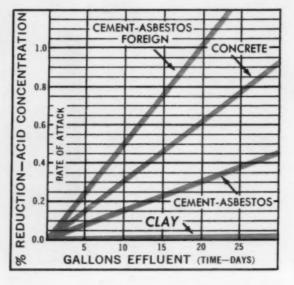
It's sulphuric acid that destroys sewer lines made of materials bought as substitutes for lifetime Vitrified Clay Pipe. And sulphuric acid—which combines chemically with the binding material in other products to disintegrate them—can't hurt Vitrified Clay, a completely inert material.

Special tests at the Clay Pipe Industry's modern laboratory at Crystal Lake, Illinois, recently illustrated just how damaging this acid concentration can be.

As you can see in these photographs and the chart, the acid started eating up the substitute materials quickly. But it didn't do a thing to lifetime Vitrified Clay.

It's a simple test. Try it yourself before you specify any product for your sanitary sewers other than Vitrified Clay. We just pumped 30 gallons of 8.6 percent sulphuric acid by weight through four different pipe specimens—in this case, domestic cement-asbestos, concrete, foreign cement-asbestos and clay.

Remember, you can't argue with the facts, and you can't repeal the laws of science. Sewer gas and oxygen are present



in all sanitary sewers. And sewer gas and oxygen combined add up to sulphuric acid, which destroys substitutes for Vitrified Clay Pipe.

NATIONAL CLAY PIPE MANUFACTURERS, INC.
1028 Connecticut Avo., Washington, D. C.
Please send me full details on the results of the acid tests on the four sewer pipe materials shown here.

(name)

(company)

(street address)

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COMPRESSION SEALED, VITRIFIED	0
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NATIONAL CLAY PIPE MANUFACTURERS, INC. 1028 Connecticut Avenue Washington 6, D. C.

To order these helpful booklets check the reply card opposite page 34.

CONSTRUCTION EQUIPMENT AND MATERIALS

New Literature on Tractor Loaders

55. Full illustrated descriptions on Allis-Chalmers TL-12 and TL-14 Tractor Loaders are furnished in bulletins MS-1386 and MS-1373 respectively. Write Allis-Chalmers Construction Machinery Div., Milwaukee 1, Wis.

Booklet Shows Design of Pre-Engineered Steel Buildings

271. Pre-engineered Butler steel buildings are available in every size, type and design to meet your building needs. In a helpful four color booklet you will find details on several basic designs for community use; answers to your questions on construction and erection; and many illustrations of typical uses. Write to Butler Mfg. Co. 7321 East 13th St., Kansas City, Mo.

The Versatile Jeep

333. Inform yourself of its many varied uses and advantages with the new 4-page in-color folder showing the full line, with major specifications. Address R. J. Kreusser, Fleet Sales Manager, Willys Motors Inc., Toledo 1, Ohio, or use reply card.

A Boon to Grounds Keepers

334. A trailer that hauls, unloads and re-loads, hydraulically. Elevator lowers to ground level for one-man loading. Write for Bulletin GC-100 to Trailevator Div., Magline Inc., Box 57, Pinconning, Mich.

Stumped by Stumps?

346. The Pow-R-Stump Cutter is operated by one man, handles stumps any width and up to 33 inches in height. Will not damage curbs, or sidewalks. A new Model 6 available—can go through a 3 foot opening—ideal for hard-to-get-in places. Five models to choose from. For literature, check the reply card or write Vermeer Manufacturing Company, Pella, lawa.

For Prompt Service Use The Reply Card

Selection of a Small **Packaged Air Compressor**

387. Catalog 1548 contains tabular and chart information on cu. ft. of air required to operate a variety of pneumatic equipment, average and continuous air supply tables and charts on ratios of compression and tables on flow of air through orifices. Check the reply card or write Ingersoll-Rand Co., News Service Dept., Phillipsburg, N. J.

Construction Materials Tested

4

418. This is the title of a new 6-page general bulletin illustrating and describing briefly a complete line of testing machines and collateral apparatus for concrete, concrete products, reinforcing bars and aggregatea. Write for it by above name to Forney's Ize., Tester Div., Box 310, New Castle Pa., or check our card neglect.

Pneumatractors, Their Tools and Accessories

497. These machines, applicable to a multi-tude of jobs, are comprehensively described in a folder that every public works official and engineer will find revealing and useful. Ask for Catalog 5945 from Schramm, Inc., West Chester, Pa., or ring the number on our card.

Complete Bulletin

On Municipal Supplies

473. Everything from leak locators to street signs is listed in the big 100 page built-tin "Municipal Supplies" published by Darley. Hundreds of different items for all city desartments are included. Get your copy of Bulletin No. 163 from W. S. Darley & Co., 2000 Anson Blvd., Melrose Park, Ill.

Compactors—A Manual on their Use and Application

S81. Information on the various types of compaction equipment in use today, including rollers and vibratory compactors, is presented and discussed in detail. Special attention to maintaining efficient compaction of various materials plus correct use of communications equipment available. Address The Galion Iron Works & Mfg. Co., Galion, Ohio, or check our

Literature on

Concrete Gunning Equipment

693. The application of gunned concrete and allied equipment used for mixing the dry blend mix for this operation is described in Form No. C7-59, furnished by the Air Placement Equipment Company, 1000 West 25th Street, Kansas City 8, Missouri.

Color Catalog Describes "Michigan" Tractor Dozers

431. A 20-page catalog on "Michigan" Models 180, 280 and 380 tractor dozers covers the design and operating features and explains how the hydrulic controls regulate all dozer operations. For your copy write to Construction Machinery Div., Clark Equipment Co., P. O. Box 599, Bentom Harbor, Mich., or check the reply card.

100 HP Motor Grader

715. Model 330-H features a constantmesh transmission, 8 forward and 4 reverse speeds, full-diesel rubber-mounted engine. With hydraulic brakes, ample strength and weight, and a wide range of blade adjustments. Write for bulletin (Form No. M6-174) from Le-Tourneau-Westinghouse Company, Peoris, Illinois, or circle reply card.

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Prostran-Polypropylene Gives You These Advantages —

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ASPHALT-PLASTIC LINERS



... for the containment of water, chemicals, brines and sewage.

"MEADOWMAT" Asphalt armorcoated plastic Liners combine the strength and elasticity of polyvinylchloride plastic with the efficiency and durability of asphalt. This new and unique mat-type liner will effectively solve many problems faced in the control of liquids. Specifically developed to meet the present need for a lightweight, low-cost durable and efficient lining material. "MEADOWMAT" Liners provide a strong, durable material with weight and substance that is easy to place without worry of punctures or tears. Easy to join and seal on-the-job...highly resistant to weathering under exposure to the elements and most acids, alkalais, salts and micro-organisms. "MEADOWMAT" Asphalt-Plastic Liners are nominally one-eight inch thick and presently available in sheets 4' wide, lengths up to 15' and weigh three-quarter pounds per square foot.

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- WATER RESERVOIRS
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SEWERAGE AND WASTE TREATMENT

What You Should Know About **Trickling Filter Underdrains**

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 208 So. Broad St., Ridgewood, N. J. Check the reply card.

Complete-Line Description of Vertical, **Enclosed Shaft, Non-Clog Pumps**

26. . . . for sewage, sump or storm-water service in all applications. Capacities from 50 to 5000 GPM and heads to 105 feet. 16-page booklet designed particularly for the busy design and layout engineer. Ask for Bulletin 124-G from Chicago Pump, 622 Diversey Parkway, Chicago 14, Ill., or use our card.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

Package Plant Provides Big-City Sewage Treatment

41. With a design based on the "Ten State Standards," the Bio-Pac employs two-stage bio-filters, primary and secondary settling and sludge digestion, all in a single corrosion protected steel shell. Design criteria for selecting appropriate sizes for residential, industrial plant, restaurant, motel and trailer court and school use are featured in Folder 2971. Also given are dimensions and installation data for 50 to 500 population equivalent plants. Write to Link-Belt Co., Colmar, Penn.

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recomendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, III.

Theory of Controlled Digestion With Floating Cover Tanks

A Short Course In Pipe Jointing

In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mig. Co., Kent, Ohio. Detailed description of pipe jointing methods; hotos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

Sewer Structures

178. This is a 48-page manual on installation design, reference data and graphs showing discharge of pipe based on Manning's formulas. Also such subjects as structural durability, material durability, selection of structures; factors influencing capacity; joints and fittings; and linings for failing sewers are covered. Copies of Manual CMS-7546 are available from the Product Information Service, Armco Drainage & Metal Products, Inc., Middletown, Ohio, or by checking the reply card.

Handy Reference on Centrifugal Pumps

115. Basic pump models, closed or open impeller and self priming solids handling series with models up to 8" size are presented in Form 9-IP-11 of Gorman-Rupp Ca., 305 Bowman St., Mansfield, Ohio. Performance curves and lists of features make this a useful reference. For yours, check the inquiry card.

Protective Lining for **Concrete Pipe and Structures**

lating active property and structures 131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif.

Elliptical Concrete Pipe for Sewers and Culverts

143. A 4-page bulletin is available from United States Concrete Pipe Co., 1500 Union Commerce Bldgs, Cleveland 14, Ohio, on the use of elliptical pipe to obtain round pipe flow equivalents in certain areas. Check the reply card for diagrams, data charts and tables that fully describe elliptical pipe sizes and compute discharge flow rates for the full range of pipe sizes.

How to Save \$264 per Mile

216. . . . in sewer cleaning is the gist of a new 8-page brochure that discusses just how some content of the costs and costs are costs and costs are costs and costs

Factory-Built Sewage **Treatment Plants**

313. If you plan one, plan first to get this latest booklet on them. Tables, data charts and specifications are compactly given in its 14 pages- Ask for Catalog 504, from Public Works Div., Schmieg Industries Inc., P. O. Box 4701, Detroit 34, Mich. Or circle this card.number.

Trenches for Water and Sewer Line Construction

384. Three Cleveland J trenchers incorporating major advances in trencher design and operating advantages are described in Bulletin I-104 available from The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio. Check the reply card for digging capacities, specifications and dimensions.

Many Fuels Will

Power Enterprise Engines

395. New bulletin tells of economies and advantages of the Enterprise Engine "Dual Fuel" system. Ideal for stationary power plants, swage treatment plants, and pumping stations. Address Enterprise Engine & Machinery Co., P.O. Box 2161, 550 85th Ave., Oakland 21, Calif.

Press-Seal Rubebr Gaskets to Seal Joints of Concrete Pipe Sewers

416. Rubber gaskets for sealing the joints of concrete sewer pipe are described fully in literature available from Press-Seal Corp., P. O. Box 482, Fort Wayne, Ind. Check the reply card for information on how these gaskets prevent water infiltration in sewer lines.

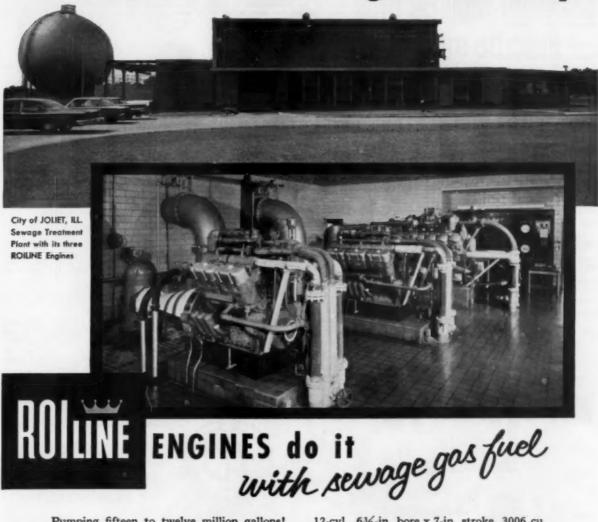
27 Diesel and Carbureted Engines **Detailed** in one Booklet

527. Describes and illustrates all types, from 16.4 to 385 hp., in weights 279 to 6,045 pounds. A brief, handy way to review available industrial engines. To get your copy, write for namphlet CR-764-K to International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.

Design Manual on Sectional Plate Pipes, Arches and Pipe-Arches

550. Size and weight tables, minimum gages for live load strutted and unstrutted, layout details and plan developments are some of the material covered in this manual. Write American Bridge Div., United States Steel Corp., 525 William Penn Place, Pittsburgh, Pa.

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WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.

New York * Tulsa * Huntington Park, Calif.

To order these helpful booklets check the reply card opposite page 34.

Weinman Horizontal Non-Clog Centrifugal Pumps

579. Non-clog pumps for sewage and sfudge in municipal plants are covered in literature from the Weinman Pump Mfg. Co., 290 Spruce St., Columbus 8, O. Specifications and dimensions are included.

Equipment For Sewage Disposal Plants

585. Sewage gas meters, gas regulators, lubricated plug valves and water meters are described in Bulletin C-5200-3, available from Rockwell Mfg. Co., Meter and Valve Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

Complete Data for Complete Treatment

667. Eimco-Process Aerobic Digestion plants for treatment of organic waste waters for reuse or disposal. Sizes for the complete treatment of 3,000 to 300,000 gpd of sanitary or organic waste. Write for Bulletin PW-1010. The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah, or use our handy inquiry reply card.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

Better Blowers for Sewage Treatment Plants

435. Engineered to reduce maintenance and replacement costs. Seven design features incorporated to give you better results. Write for detailed specifications to Sutorbilt Corp., Dept. F, 2966 E. Victoria St., Compton, Calif., or use the reply card.

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675. An aerobic digestion type sewage treatment plant sized to the requirements of small commercial establishments has been added to the Yeomans line, to fill the need for a plant between the Cavitette and the Cavitator. Twin mechanical aerators are installed in a two-compartment aeration tank. Waste flow through the plant is through a trash tank to the aerators and on to a settling tank fitted with a sludge return mechanism. Application-selection data available on request from Yeomans Brothers Co., 2000-1 North Ruby St., Melrose Park, Ill.

REFUSE COLLECTION AND DISPOSAL

Where Does It Go From Here?

63. That is the title of new 12-page booklet, D 930, with thorough discussion of garbage disposal by sanitary landfill method. Read the latest report from the experts. Caterpillar Tractor Co., Peoria, Ill., or check card.

Load-Packer 600 Points the Way to the Best in Refuse Collection

188. Bulletins W-200, W-220 and W-221 explain how the Gar Wood Load-Packer gives aster operation, bigger payload, more compaction, a larger hopper and more dependable operation. Write Gar Wood Industries, Inc., Wayne, Mich., or check the reply card.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Literature Describes M-B Contain-O-Pack System

190. A 6-page catalog describing the M-B Contain-O-Pack, a complete low cost containerized refuse system for private haulers and municipalities is available from M-B Corp., New Holstein, Wisc. Check the reply card.

Methods and Benefits of Sanitary Landfill

469. Information on Sanitary landfill methods, organization and necessary equipment with which to carry out the job is available from the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin MS-1159.

Progress in Refuse Removal

493. . . . registers a new high mark with the Hobbs Hyd-Pak 60 model. Gives lower loading height, watertight body, 3 "extra" yards all in one ultra-modern, proven piece of equipment. For details on this unit and a pick-up container system, address the Hobbs Hyd-Pak Division, 609 N. Main St., Fort Worth, Texas.

Best Way to Beat the Long Haul Problem on Refuse

547. . . is fully described and illustrated in this new folder. Tells how your Dempster equipment containers can be converted for super-service. Gives you the step-by-step process to modernize what you have now. Write for Folder 6073 from Dempster Bros. Inc., Knoxville 17, Tenn., or just circle the number on our card.

Modern Methods in Sanitary Landfills

699. Up-to-date data, pictures and explanation of sanitary landfill, its methods and equipment are covered in this valuable bulletin from The Oliver Corp., 19300 Euclid Ave., Cleveland 17, O. Check the reply card for information on satisfactory garbage and refuse disposal methods.

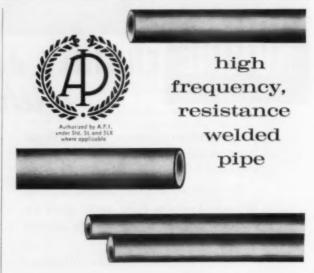


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Rock salt has unique de-icing properties not combined in any other single de-icing chemical. Unlike abrasives or other ice-control products, straight salt works three ways to get rid of ice and packed snow:

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Morton Safe-T-Salt* is a screened and graded straight rock salt. Its name was chosen to emphasize the primary reason for street and highway de-icing . . . public safety. Morton Safe-T-Salt gives that safety quickly, cleanly, and economically.

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residue as sand and cinders will.

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To order these booklets check card opposite page 34.

WATER WORKS

Vacuum Flash Evaporators for Large-Scale Production of Potable Water

21. How sea and brackish water can now be de-salted and utilized at a reasonable cost is the subject of two complementary brochures. Write for them to Richardsons, Westgarth 7 Co., Ltd., P. O. Box 2, Wallsend, Northumberland, England, or just use our reply card.

Equipment For Water, Sewage and Industrial Waste Treatment

24. The complete line of Jeffrey equipment for treatment plants is covered in a 64-page Catalog 952 available from The Jeffrey Mfg. Co., Columbus 16, Ohio. Check the reply card for information on bar and disc type screens, traveling water screens, grinders, grit collectors, garbage grinders, sludge, draw-off valves, chemical feeders, bucket elevators and scum removers to mention some of the equipment.

Ball and Socket River Crossing Cast Iron Pipe

33. Literature is available describing Clow ball and socket cast iron pipe for river crossing, or any installation where full 15 degree free turning deflection is desirable. For description and specifications, address James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill.

Handbook of Cast Iron Pipes and Fittings

52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use in reference.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

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100 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH, Chlorine and Phosphate Control and descriptions of comparators for making colorimetric analyses. A 100 page booklet is available by checking reply card. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

High Frequency Resistance— Welded Steel Pipe..

72. Available in 6" to 16" diameters, in wall thickness to .219, special wrappings and coatings available. For attractive booklet, including specifications and details of field joints write Valley Mfg. Co., Valley, Neb., or circle our inquiry card.

Guide Book Information for Emergency Power

153. This book covers what to do when commercial power fails in a fire, flood, hurricane, war and other national disasters, Check the reply card or write Caterpillar Tractor Co., Engine Div., Peoria, Ill., for a copy of "The Four Horsemen of the Space Age."

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, III.

What You Should Know About Steel Reservoirs and Standpipes

79. The function of ground storage structures in water distribution systems, specifications and maintenance recommendations, are included in an artistic new 20-page booklet. Get yours from Chicago Bridge & Iron Co., 332 So. Michigan Ave., Chicago 4, Ill., or circle our card-number.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Fa., or check the reply card.

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184. Get permanent water-tight joints automatically with K & M "Fluid-Tite" couplings for K & M asbestos-cement pressure pipe. Full details on this faster installation and self-energizing couplings are available from Keasbey & Mattison Co., Ambler, Penna.

Asphalt-Plastic Liners for Ponds and Reservoirs

223. To effect complete containment and/or control of water and sewage, in lining reservoirs, sewage lagoons and sludge ponds. Three sheets of facts on this product available by writing for Bulletin No. 905 to W. R. Meadows. Inc., 2-18 Kimball, Elgin, III., or use our card.

Meters and Instruments For Water Works

224. An attractively arranged 40 page catalog in full color issued by Hersey-Sparling Meter Co., 225 No. Temple City Blvd., El Monte, Calif., furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the reply card for your copy, or write for Bulletin 314.

Foxboro Magnetic Flow Meter

238. The Foxboro magnetic flow meter measures water and wastes electrically, without any line restriction. No loss of head, no fouling, even with alurries. For detailed illustrated Bulletin 20-14B check the reply card or write The Foxboro Co., Foxboro, Mass.

To Meet Increasing Water Demands, These Two Steps Will help

247. Two new products designed to help meet constantly increasing demands for water are described in a folder of Hersey-Sparing Meter Co. 250 Elm St., Dedham, Mass. These are a flow analyzer that provides strip chart rate of flow and volume records, and a two-rate register that can be substituted for the flow analyzer. Get this data by checking reply card.

Outline of Modern Water Treatment Equipment

248. Bulletin 4433 is recommended for engineers who need a basic refresher course on treoatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment. Check the reply card or write The Permutit Co., a Division of Pfaudler-Permutit Inc., 50 West 44th St., New York 36, N. Y., for your copy.

Pipe Cutter for Cutting Large Size Pipe

254. An all-purpose pipe cutter that can cut pipe in or out of the ditch is described in a bulletin available from Ellis & Ford Mfg. Co., P. O. Box 308, Birmingham, Mich. Check the reply card for sizes and parts list.

A Quick Comparison of Water Meters Helps

274. That is the purpose of the new bulletin describing the newest accomplishments in water meter design and manufacture. With it comes a Condensed Catalog of the Rockwell line. Ask for Bulletin No. W-811 from Rockwell Mfg. Co., Municipal & Utility Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

(More listings on page 52)



with PERFECT-BALANCE DUMPING

- . STEADY AS A ROCK DURING THE DUMP
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- . FASTER, CLEANER DUMPS

Perfect-Balance dumping — even on the roughest terrain — gives you faster, safer dumping action with the new M-B PACK-KING refuse collection body. Your truck driver doesn't spend valuable time "jockeying" the truck around to find a level spot to dump. Less time at the dump means more profitable hours servicing routes.

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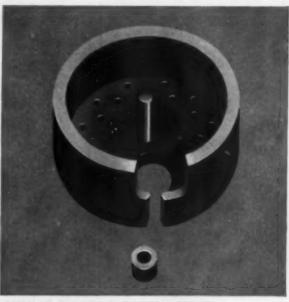
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STRAIGHT LINE MAGNETIC DRIVE

A simple, powerful magnetic coupling transmits every motion of the measuring chamber directly to the sealed register in a vertical line. The permanent Alnico magnets are completely sealed. Their strength will not deteriorate with time.



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These better "magnetic" meters cost you no more to buy and cost you much less to maintain than other types of more complicated design. Since they have the fewest parts to wear they are easiest and most economical to repair.

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With Long **Lasting Cutter Wheels**

Designed for water works men who appreciate the rugged construction of drop-forged frame and links; and a tool that assures no pipe breakage, no re-cutting and no spoilage.

THREE SIZES

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311. You will profit by having this 4-page condensed bulletin which illustrates and describes the Aurora Centrifugal and Apoc Turbine Type Pumps with capacity ranges from 1 to 9000 GPM, and heads to 600 ft. Just write for your copy to Aurora Pump Div., The New York Air Brake Co., 630 Loucks St., Aurora, Ill., or circle number on card herewith.

Vertical Turbine Pumps

357. Described in an unusual 4-color illustrated brochure that you will want in your pump data files. Write for it by above title to Fiese & Firstenberger Mfg., Inc., 2494 Railroad Ave., Fresno, Calif., or use our card.

Information on

Boring Machines

the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Earthworm Boring Machine, Inc., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included.

Gate

Valves

369. A new publication has been issued especially for designers of sewage and waste treatment plants. Write for Circular No. 24 to M & H Valve and Fittings Co., Anniston, Ala., or check the card-number.

Hinged and Rotary Pipe Cutters

377. 16-page new catalog with pages of special interest to water works people. Describes and illustrates in color six basic lines, from tubing cutters, to 30" iron or steel pipe ones. Includes prices and technical data. Write to Reed Mfg. Co., Erie, Pa., for catalog No. NP-6-61 or use our card.

Water Works Couplings, Clamps and Sleeves

426. Fully described in useful 24-page booklet covering all your pipe needs. Ask for "Water Works Catalog" of Dresser Mfg. Div., Bradford, Pa., or just circle the number on this card.

Manual Answers Your **Water Meter Questions**

440. This valuable reference covers the complete line of Trident water meters, giving full descriptions of each type and providing also helpful background information on metering and its advantages. Get your copy of the 28-page Trident Water Meter Catalog. Form 421-1, by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

Water Meters with Choice of 7 Features

\$21. . . . and geared to mineral and chemical characteristics of your water. Complete design flexibility built-in to meet varied needs the country over. Get all the facts with Bulletin 58 of Buffalo Meter Co., Dept. PW, 2917 Main St., Buffalo 14, N. Y., or check the card-number.

Handbook on How to

Lay Concrete Pressure Pipe

524. Manual on concrete pipe laying instructions is available from Price Brothers Co., Dayton, Ohio. Check the reply card for information on how to dig the trench and handle the pipe, make the joint and the pipe bedding

Gas and Gasoline

Engines Described in Literature

gas and gasoline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

To Insert Valves Under Pressure . . .

553. . . let your first step be review of this "step-by-step" folder on Mueller tapping and cutting in sleeves and valves. Write Mueller Co., Decatur, Ill., for Form W-8899 or circle number on our card.

Bitumastic For Lasting

Protection Against Corrosion

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Metering Pumps

540. Get the full treatment in twin brochures filled with valuable data to the water works head who is on the lookout for all that is new in good chemical feed pumps. For yours, address Wallace & Tiernan, Inc., Belleville 9, N. J., or check our card-number.

Here's Help in Fighting to End Water Pollution

593. A practical, attractive promotion kit is offered showing how to promote successful bond campaigns to finance clean waters programs for your community. Contains literally everything you need and can use. For yours, address Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill., or circle our card-number.

Keeping Up-to-Date on Fire Hydrants . . .

608. will be made more certain by having this latest folder on Iowa hydrants in your files. Dependable design; ground line break flange construction. Ask for Bulletin X9 of Iowa Valve Co., Oskaloosa, Iowa, or circle the reply card.

Water Storage Review

617. Contains interesting picture stories of the various capacities, styles, shapes and appear-ances of steel water storage tanks. For your copy just write Steel Plate Fabricators Asso-ciation, 105 W. Madison St., Chicago, Ill., or use our reply card

A "New Look" in Magnetic Drive Water Meters

648. Easy-to-read features of the first magnetic drive meter with a disc meter chamber are illustrated and emphasized in Bulletin DER-961, available from Badger Meter Mfg. Co., 4545 W. Brown Deer Road, Milwaukee 23, Wisc.

Turn Your Water Meter Reading Inside-Out

471. The Visi-Meter is a remote recording and indicator system that eliminates the need of entering the home to read water meters. It records within an accuracy of 0.1 percent. Check the reply card or write Visi-Meter, Inc., 301 North 17th St., Kansas City, Kans., for

Bulletin Covers Step-by-Step Action on the Water Problem

489. A step-by-step outline of action tell-lag how the responsible citizens can help their officials extend and improve the local water sys-tem through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Pruden-tial Plaza, Chicago 1, Illinois.

Water Filtration

Costs Can Be Reduced

672. The "Celite" system of diatomite filtration makes possible reduced installation cost, with space requirements a fraction of those for equivalent sand filtration. For informative literature write Johns-Manville, Box 14, New York 16, N.Y.



Double the clear water capacity at half the installed cost with Celite Filtration

Because diatomite filtration systems using Celite® filter aids require one-fourth the housing space of equivalent-capacity sand systems, real estate and construction costs are drastically reduced. These savings, combined with the low initial price of a diatomite unit, permit the construction of new water filtering plants at one-half the cost.

Celite is the most efficient and economical filter aid available. It removes all suspended solids—including amoebae, floc and algae—while maintaining maximum flow rates. And, this clearer, brighter water is produced at a lower cost because a compact, semi-automatic diatomite system is easily operated and maintained by regular municipal water personnel.

For full information write: Johns-Manville, Box 325, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable address: Johnmanvil.

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A significant advancement in small natural gas engines

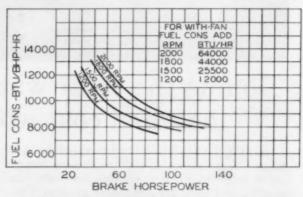
· Outstanding longevity · Outstanding fuel economy

Now, the same basic features that have earned Cat Natural Gas Engines industry-wide recognition for long life and low cost operation are yours in the new G333. The compact G333, like all Cat Natural Gas Engines, is a direct conversion from its diesel counterpart giving you full advantage of diesel strength for the less strenguous demands of gas operation.

Results: Up to 25,000 hours of operation before overhaul . . . higher compression ratios for optimum fuel efficiency and increased output per cubic inch displacement . . . continuous full rated power, derating only for altitude and temperature. Another cost saving feature of the G333 is the low-tension ignition system which is standard equipment. This system makes higher compression ratios practical and extends breaker point and spark plug life.

The new G333 develops 130 HP @ 2000 RPM and 75 KW as an 1800 RPM Cat Electric Set. It is available in compression ratios of 12:1 for processed natural gas and 8.5:1 which allows burning of a wide variety of gaseous fuels, including well-head gas.

For further information on the G333, contact your Caterpillar Dealer or write direct. The Cat Natural Gas Engine line ranges to 720 HP and 450 KW.



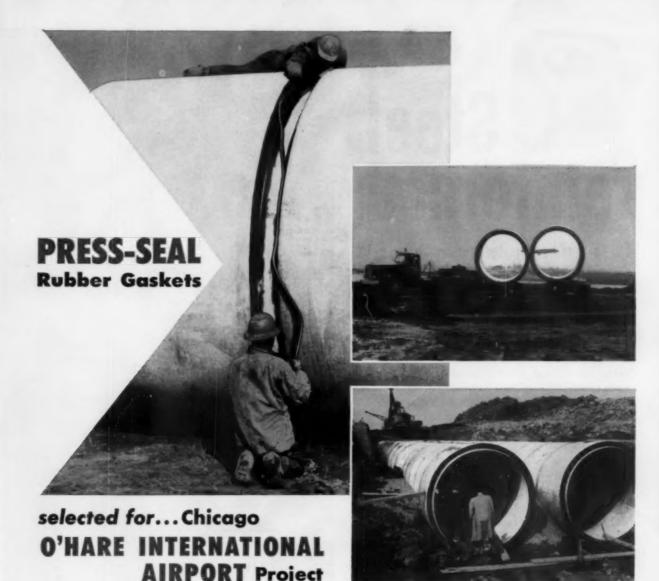
Fuel consumption for G333 (12:1 compression ratio) based on 1000 BTU low heat value fuel.

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Engine Division, Caterpillar Tractor Co., Peoria, III., U.S.A.

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Press-Seal rubber gaskets provide permanently leakproof seals at every point of the 20 miles of concrete sewer pipe laid in this Chicago airport project. Pipe: Approximately 10 miles of 12" to 108" diameter pipe supplied by Durgom Concrete Pipe Company, South Beloit, Illinois.

Contracting Agency: City of Chicago, Dept. of Public Works. George L. DeMent, Commissioner. Architect-Engineers and Consulting Engineers: Naess & Murphy, Chicago, Illinois. Director of Engineering: Walter G. Metschke. Utilities Coordinator: Raymond E. Wilson. Chief Construction

Engineer: Edmund Plawin. Site Construction Engineer: Lyle Thompson. Construction Company: Santucci Construction Company, Skokie, Illinois. Pipe Supplier: Durgom Concrete Pipe Company, South Belait, Illinois.

Write for detailed information and engineering data on Press-Seal confined compression type gaskets, including special materials for lines carrying oil content, acid content, or common sewage. Ask for our manual No. 4—Better Seals for Concrete Pipe. If you wish, send information about your special problems.

The lowest cost material item in any Pipe-line Project is a PRESS-SEAL Gasket



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Steel reinforced

for longer life in storm sewer service!

Concrete pipe reinforced with strong USS

AMERICAN Welded Wire Fabric solves drainage problems.

Albuquerque, like most southwestern cities, is spreading out. You see new construction almost everywhere you look. This photograph shows some of the activity that goes into transforming the wide open countryside into new residential areas. It was taken in the North East Heights development and shows the laying of reinforced concrete pipe for a storm sewer. In this project, approx. 17,000 lineal feet of reinforced concrete storm sewer pipe from 24" dia. through 72" dia. was laid.

The pipe shown is 72" pipe, and every foot of it was steel-reinforced with USS AMERICAN Welded Wire Fabric to give it the strength and durability to withstand heavy loads and assure long service life. It was pre-tested to meet the rigid requirements of ASTM Specifications C76-57T, and will withstand loads exceeding 100,000 lbs.

A large number of concrete pipe manufacturers are using USS AMERICAN Welded Wire Fabric to get greater strength and durability. This quality wire fabric is made on precision machines to the closest of tolerances ±0.003"—with center to center spacings held to ¼". It is prefabricated from cold-drawn, 60,000 psi min. yield strength wire. All intersections are electrically welded to assure positive mechanical anchorage in the concrete. For more information about USS AMERICAN Welded Wire Fabric—write American Steel and Wire, Dept. 1455, Rockefeller Building, Cleveland 13, Ohio.

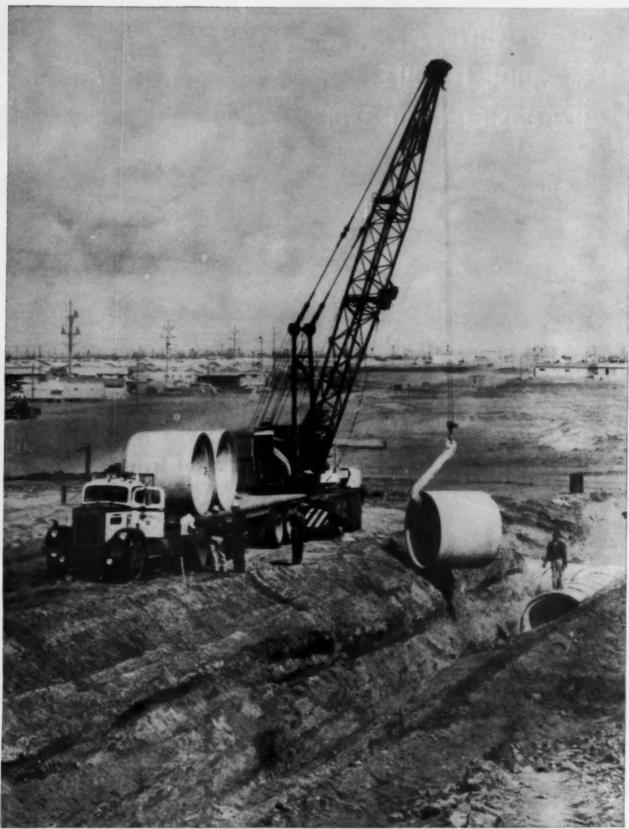
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Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors Tennessee Coal & Iron Division, Fairfield, Alabama, Southern Distributors United States Steel Export Company, Distributors Abroad



Project: Storm Sewers, North East Heights, City of Albuquerque, N.M. Engineers: Gordon Herkenhoff & Associates. Contractor: C. R. Davis Contracting Company. Product: Reinforced Concrete Pipe ranging in size



from 24" to 72" dia. Reinforced with USS American Welded Wire Fabric. Manufacturer: Pipe by American-Marietta Corporation. Reinforcement by American Steel and Wire Division of United States Steel.

This mark tells you a product is made of modern, dependable Steel.



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pipe repairs

are easier than ever

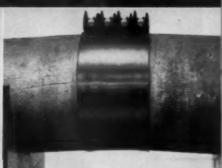
with the Dresser 360 Clamp!



Dresser "360" repairs steel, cast iron or A-C pipe. One-side wrenching lets bolts be tight-ened from easiest position.



Drop-in bolts mean fast, easy assembly, no loose parts. Simply spring clamp around pipe, drop in bolt heads and tighten nuts.



The "360" holds pipe bottle-tight, even when deflected as much as 5°. Also, it is not troubled by misalignment up to 1/5".

Nothing beats the speed and ease of repairs with the Dresser "360" All-Around Repair Clamp! With its drop-in bolts, there's no nut removal, no loose parts in the ditch...one set of lugs means bolting where it's easy. The gasket—a thick, smooth, butt-joined blanket has 65% more rubber for absolute sealing. Doesn't wrinkle. The Dresser "360" provides %" adjustment—fits more pipe sizes, means fewer clamps to stock. For details on the "360", or any of THE DRESSER LINE for coupling or repairing pipe — write us, or call your nearest Dresser Distributor.

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OIL - GAS CHEMICAL ELECTRONIC INDUSTRIAL

are your meter specifications REALLY UP TO DATE ?

It's good business to take advantage of every improvement. It's also good business to avoid the pitfalls of progress... common pitfalls like obsoleting previous investments at a loss... or committing yourself to a new design that turns out to be incompatible with the next improvement... or burdening yourself with too many makes and models to take care of.

Trident disc meters give you flexibility, all the advantages of modern sealed construction, and protect your investment. Every improvement has been designed to fit every older Trident. You actually modernize any or all of your Tridents, depending on your conditions, as you repair them . . . at far less cost than "scrap and replace" programs. Every design "first" in Trident's history, including the new Trident Model 60 Sealed Meter . . . and every design improvement now on our drawing boards . . . maintains this rigid 60-year-old policy.

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New Trident Model 60 Water Meter the sealed meter that can be repaired, reset, and calibrated economically in your own shop . . . with complete interchangeability of sarts that fit older Tridents and climinate scrapping major units because of wear in minor parts.



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I thought comparators were pretty much the same, but was I wrong. Broke two of those fragile, individual glass standards the first week . . . and things were really fouled up. Got a Taylor Comparator as soon as I could . . . and I'm really sold on Taylor. You can't beat a slide with the color standards right in it for convenience and easy use.

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Taylor Water Analyzer for colorimetric water analysis. Also available —Taylor-Enslow Slide Chlorimeter for pH, chlorine tests. Also ideal for control of swimming pool water.

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SEE YOUR DEALER for Taylor Sets or immediate replacement of supplies.

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LEGAL ASPECTS

OF

PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Improvement of Trunk Line Highways

Knott v. City of Flint, 109 N. W. 2d 908, a Michigan case decided June 29, 1961, was an action by abutting property owners to enjoin the collection of assessments for the improvement of trunk line highways, i.e. for the widening of Davison road and Dort highway, in the City of Flint.

The cost of each project was divided among the Federal government, the State of Michigan, and the City of Flint, the latter to pay one-fourth of the expense (about \$59,000). To cover its share of the cost of the projects the city determined to create special assessment districts along each thoroughfare, and to levy special assessments on the property fronting the respective roads. Properties of the plaintiffs were assessed, but the payments were not made. Instead, suits were brought by plaintiffs to enjoin the collection of the assessments and to declare the municipal action invalid. It was the claim of the plaintiffs that the improvements made were not beneficial to abutting properties, but, on the contrary, were detrimental to the use thereof. It was further claimed that the projects were related to the general welfare and that accordingly the city's portion should have been met from municipal funds rather than by special assessments.

The plaintiffs introduced evidence to show that traffic had increased greatly as a result of the widening of the roads; that ingress and egress to places of business were rendered difficult and in some instances impossible because of the traffic; that the properties along the highways could not be sold because of the situation that had developed; that a used-car lot was forced to

discontinue business because potential customers could not readily enter or leave the premises; that certain properties assessed could not be sold for the amount of the special assessment thereon; and, that the widening of the roads depreciated values generally along each thoroughfare, except as to specific properties having means of ingress and egress other than on Dort highway or Davison road.

On the other hand, the city offered evidence to show an increase in the assessed valuation of properties on both thoroughfares and that a portion of the increase was due to widening of the streets and the commercial advantages afforded by the facility for vehicular traffic.

The court granted the injunction, thereby preventing the collection of the assessments from the plaintiffs, on the ground that the improvements were for the benefit of the general public and resulted in actual burdens to the abutting owners. The court said, "It is not right, it is not fair, and, we must add, it is not lawful, to make the few foot the cost for what is a benefit to the many. To inflict upon the abutting owners the added burden of paying for the widening of these two roads would, in the Court's opinion, amount to unconstitutional confiscation of their property."

Condemnation of Land for Highway Purposes

Redfield v. Iowa State Highway Commission, 110 N. W. 2d 397, an Iowa case decided August 15, 1961, was a proceeding to condemn real estate owned by the plaintiffs for highway purposes. The proceedings were held before a jury, which returned its verdict increasing the amount of the award above that of the condemnation commission.

SPECIFICATIONS for your files



FOX Mountable Materials Spreader

for sand • cinders • chips • salt • calcium chloride



MOUNTING

On or off any standard dump body in only 15 minutes. T-head fasteners, cranks and base adjustment channels make this possible. Truck is quickly freed for other work.



DADING

Sturdy 36" rods make up cover grids that break up lumps. Allow only spreadable material to pass through. Increases spreading efficiency and prevents damage to



DASH-MOUNTED CONTROLS

Fingertip control from inside cab makes operation a one-man job. Panel includes—spreader engine ignition and starter switches, volume regulation control and electric clutch switch. Sanding at speeds up to 40 MPH.



FEED AUGER

Heavy-duty feed auger eliminates feed aprons and chains, the source of most frequent breakdowns. Auger mounted on 4 Timken tapered roller bearings, completely shielded from abrasives.



SPINNER

Adjustable for 8 to 40 foot spreading widths. Works close to ground—spreads under parked and passing cars . . . ahead and beneath rear truck wheels for added traction.

GENERAL SPECIFICATIONS

Model	Box Longth	Box Width	Weight Empty	Capacity Heaped* (yards)
8S57 9S57 10S57 12S57	8' 9' 10' 12'	80° 80° 80°	2435 2610 2849 3156	5 5% 61/2

*4", 6" and 12" height additions to box increases capacity—up to 12 cu. yds. on Model 12S57.

-Wisconsin air-cooled, 18 H.P. @ 3500 r.p.m. with starter, generator and enclosed drive reduction.

BODY

—10 gauge prime steel. All welded construction with reinforcing ribs.

REARINGS

—10 Timken tapered roller bearings and two sealed half bearings plus engine bearings.

AUGER

 Mounted in two pillow blocks outside of the box, each with two Timken Bearings, fully shielded, mounted on a sleeve with an internal spline.

CONTROLS

—Manual controls outside driver's window, standard.

Optional electric remote control panel on truck dash.

BPINNER

—18" diameter. Height adjustable by 4 position lever for 8 to 40' spread.

MOUNTING

-Quickly attached without drilling holes or welding.

GRIDS

-36" rods on 3" centers. 4' and 5' sections.

SPECIAL

-Ideal as Seal-coater for summer road work. Special attachment converts unit to a Trench Filler.

The Fox Materials Spreader will cut your labor, time and equipment expenses to the bone. A catalog... case history reports... even a no-obligation demonstration are yours for the asking.

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PIPE CUTTER

- Closed Frame Construction assures complete rigidity with less weight.
- 4-Wheel design needs minimum swing of handle.
- 4-Point pipe guide aligns cutter for perfect tracking of wheels and a right angle cut.
- Quickly interchangeable wheels for steel or cast iron.
- Needs only 3" space to pass under 12" pipe.

For ditch work or similar closequarter operations these new Reed Cutters are practically indispensable and fully justify replacing whatever cutting equipment you are now using.

You can, for example, cut 8" steel pipe in less than five minutes, and cast iron pipe even faster.

Available in five sizes for steel or cast iron pipe from 1" to 12".

The principal issue on appeal was whether it was proper to have admitted evidence of sales of claimed comparable properties as evidence of the value of the tract then taken.

Under a recent decision of the Iowa Supreme Court, the former rule had been reversed, and the rule was established that evidence of such sales would be admissible if, in fact, the property and the sale were similar and comparable. In the present case, however, the court held that the sales were not similar and comparable because: (1) In one of them, the payments were predicated on the contingency that future sales of lots included in the tracts would be sold; the court held that this rendered the purchase price too speculative to be a fair test of market value. (2) In one of the sales, a part of the consideration was not one paid in money. (3) In another one of the sales, the time for payment extended over sixteen years; it was held that conditions might be far different as to the value of property during that period, so that it did not sufficiently reflect actual cash market value.

For these reasons, the case was remanded for retrial without the admission of these sales or evidence of the value of the tract then taken.

Paving Contract

City of St. Clair Shores v. L. & L. Construction Company, 109, N. W. 2d 802, a Michigan case decided June 29, 1961, was an action by a city against a paving contractor and its surety for \$33,000 damages based on the contractor's alleged breach of contract in not paving according to specifications.

The paving was installed in November and December. Defendant was prevented from beginning construction earlier because he had to wait until a storm drain had been installed by another contractor. The job was done at this time of the year because of extreme pressure on the part of some land developers, according to the trial court's opinion.

The trial court held, and the Supreme Court of Michigan affirmed on appeal, that the city was estopped from claiming that the contract was not fulfilled—despite the fact that the pavement showed various stages of disintegration the following May—because its inspector had inspected the job daily and at no time objected or complained about the contractor's method of construction.



REED MANUFACTURING COMPANY

The best winter STRAIGHT STERLING ROCK SALT



Every test devised shows straight rock salt the most efficient, economical way to safe, bare pavements.

What is a safe pavement? National Safety Council definition: "Maximum safety is provided when ice and snow are completely removed, leaving a bare pavement." Straight Sterling Rock Salt's melting power is the fastest, surest way to bare, skid-proof pavement.

How effective are abrasives P Spread abrasives on snow, and they sink down out of sight and out of traction; on ice—wind and traffic scatter abrasives off the road. In the spring you'll waste time and money cleaning them out of storm sewers, catch basins and drainage ditches.

How about abrasives and salt mixes P Abrasives cut down salt's terrific melting power—even insulate the snow and ice from the sun's rays. You still have a lot of costly hauling, and you still have to clean up the mess in the spring.

Gosts? Sterling Rock Salt is most economical. One truckload of Sterling Rock Salt goes five times further than the same truckload of abrasives. Sterling Rock Salt costs about one-half to one-third as much as other ice-

melting chemicals. Thus, your highway maintenance dollar goes further—much further.

Is rock salt effective at lower temperatures? Straight Sterling Rock Salt has effective melting power at temperatures below zero! Just increase the amount of rock salt as the temperature drops.

And other removal methods? The Department of Engineering of one of our largest cities tested straight rock salt against chemicals, abrasive mixes, and radiant heat. Result: This large city now uses nothing else but straight rock salt.

Sterling Rock Salt leaves a bare pavement . . . freezes dry. Other chemicals frequently dissolve so quickly that they do not melt through the snow or ice to the pavement. Dangerous refreezing occurs when the temperature drops. When they do melt to the pavement, other chemicals do not freeze dry but leave a slick, wet, dangerous driving surface.

To order Sterling Rock Salt contact our nearest district office. International Salt Company, Clarks Summit, Pa.

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REPUBLIC SECTIONAL PLATE ARCHES HELP SOLVE STORM SEWER PROBLEM IN CLEVELAND



Close-up of one barrel of the storm sewer under construction, shows details of the structure.



Back-filling of the installation will be followed by landscaping to add to the beauty of the park.

An existing storm sewer located in southeastern Cleveland was being seriously overtaxed by runoff from an 800-acre area. Commercial buildings and homes located directly over the structure made enlargement impossible. Adding to the problem, the sewer emptied into an open stream running through Cranwood Park, thus hampering recreational activities.

Following a recommendation of the Regional Planning Commission, Cleveland's Engineering Department designed a second branch of the sewer to handle 390 acres of the area. The two branches intersect at the edge of the park, where they empty into a double barrel Republic Sectional Plate Arch structure.

City Sewer Design Engineer, E. C. Richardson, noted that the type of sectional plate construction employed here has been successfully used in 12 major Cleveland projects. It has proved to be a most efficient and low-cost method for meeting a variety of different design and performance requirements.

THREE-WAY ECONOMY WITH REPUBLIC SECTIONAL PLATE CONSTUCTION

The true cost of a drainage structure includes cost of materials, assembly or labor costs, and life-of-the-structure cost. Republic Sectional Plate Construction gives you exceptional economy in all three areas: initial material costs that are well below the price of other types of drainage structures; simplified design features that eliminate the need for highly skilled labor and make for fast assembly; and the built-in reliability of resilient, galvanized, heavy gage steel.

Fast, easy-joining Republic ELECTRUNITE® GROOVED-END TUBING is a money-saving way to install temporary, semi-permanent, or permanent fluid, gas, and air lines. No threads to cut, fittings snap on to join sections tightly in seconds.

Strong, Modern, Dependable







EACH BARREL of the double barrel installation has a 10'0" span and a 5/2" rise. The arch is made of 8 gage Republic Corrugated Sectional Plate. Concrete invert has a vitrified liner. Each barrel was designed for capacity of 812 C.F.S. The first installation of this design was constructed in 1934, and proved so effective that city engineers have used it in 11 other major projects.

Architects and Engineers—City of Cleveland, Engineering Division. Louis L. Drassler, Director of Public Service; J. R. Katz, Commissioner of Engineering; Clarence Lillig, Engineer in Charge of Construction; E. C. Richardson, Design Engineer; Square & Marra Construction Company, Bedford, Ohio, Contractor.

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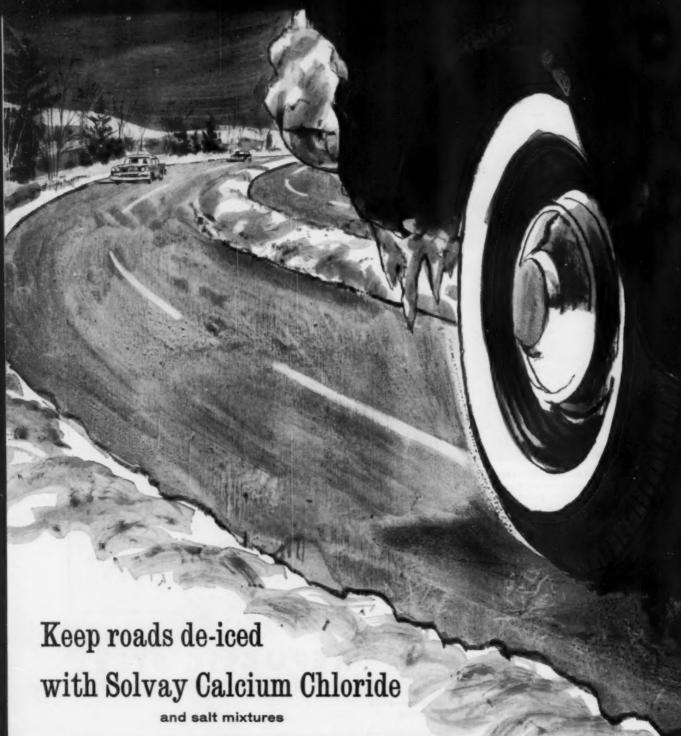
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- . Effective melting action well below zero
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And, calcium chloride mixed with salt or alone is easy to handle. Easy to store, too—outdoors under tarps, or in indoor sheds or covered bins. Based on your regional weather conditions, the local Solvay representative will be glad to recommend specific mixture ratios, application rates, and handling methods for greatest effectiveness and economy. Why not contact him today?



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"WHERE WATER'S CONCERNED, THERE IS SIMPLY NO ALTERNATIVE TO PLANNING AHEAD!"

says R. LEWIS BARTON, Oklahoma City

"Our decision to establish a new water supply was based on the knowledge that Oklahoma City's future growth and prosperity were at stake. Our population has increased 33.2% in the past decade. By the year 2000 we estimate a further gain of 66% over today's population.

"Industry, too, is moving in. We feel certain that Western Electric would never have erected their new \$36-million plant without assurance of adequate future water supplies. Then there's the new FAA Aeronautical Center which will eventually employ five thousand people. And with completion in 1963 of the new water line from the Atoka Reservoir, we'll be ready for any industry!"





MODERN FILTER PLANT READY TO HANDLE POPULATION GROWTH OF THE NEXT 20 YEARS!

Pumping 12 million gallons per day, the new Hoskins Filter Plant at Charlotte, North Carolina, has increased the city's water supply by 50%. And as the city grows, so will the capacity of the filter plant. It is designed to supply an ultimate of 72 million gallons per day—more than enough water to provide for the 420,000 population expected by 1979.

And the new plant will remain an attractive addition to its industrial neighborhood. Precast panels of concrete form the walls. Their lively texture and color will keep the building looking clean and modern through years of service to the community.

Hoskins Filter Plant, owned and operated by the city of Charlotte, North Carolina.

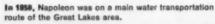


NEW CHARLOTTEBURG DAM AND RESERVOIR HELP NEWARK MEET ITS UNIQUE WATER SUPPLY PROBLEM

Busy, bustling Newark, New Jersey, is the only city in the United States whose population doubles during daylight hours. The newest project in the city's continuing program of water improvements is the Charlotteburg Dam. This new reservoir provides an additional storage capacity of 2.9 billion gallons from the Pequannock River watershed. Construction of the project provides for the most efficient use of the four existing reservoirs in the area.



Charlotteburg Dam, largest mass concrete dam in New Jersey, is 685 feet in length and 87½ feet high.

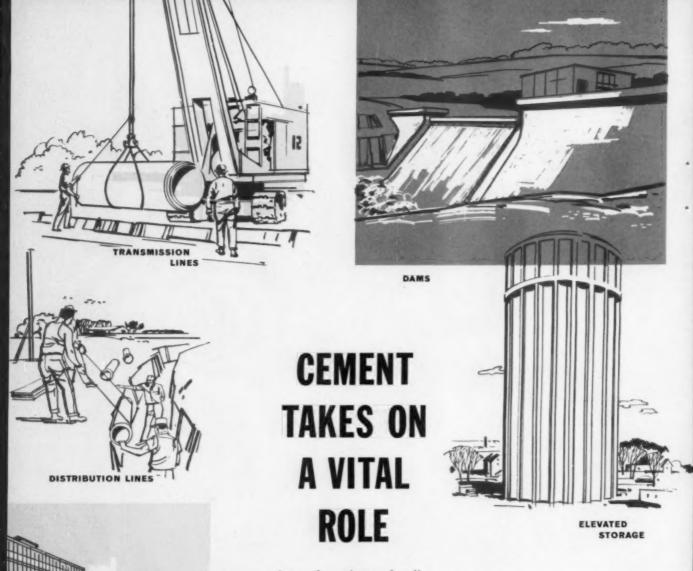




NEW WATER LINES WILL BRING INDUSTRIAL GROWTH TO NAPOLEON, OHIO!

Located on the Maumee River, Napoleon has an abundant water supply. But without proper treatment and distribution facilities Napoleon has not been able to promise relocating industries all the water they needed. And industry has been passing the town by.

Now, you see new asbestos-cement pipelines going in all over town. Plans move ahead for a new treatment plant to double present capacity, allow for even more expansion in the future. Napoleon is back in the business of growing . . . with assurance that new manufacturers will soon be bidding for choice industrial sites.



Across the nation, modern living soaks up water by the billions of gallons for washing machines, air conditioners, extra bathrooms. By the 1980's, more than 200,000,000 Americans in urban communities will need 28 to 32 billion gallons of water every day. This totals nearly twice the present day demand for water in our cities and towns.

TREATMENT

Everywhere today, the need for new water sources, new treatment, storage and distribution facilities is urgent. In such a total program, of course, cement earns a vital role. The strength of concrete, asbestoscement and other cement products, their durability, and potential for beauty as well as efficiency, make them favored products for planners and builders.

Engineers in nationwide offices of the Portland Cement Association cooperate with city planners and engineers, supply up-to-date information on the newest uses of portland cement for modern water facilities. For details, contact your local PCA office.

PORTLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of concrete MODERN

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NEEDED:

A MEANS OF DETECTING ICING CONDITIONS

ON THE ROADWAY SURFACE OF BRIDGES

AND STRUCTURES, AND WARN APPROACHING

MOTORISTS.

DEVELOPED:

ICE, SNOW, AND FROST DETECTOR WHICH AUTOMATICALLY DETECTS THESE CONDITIONS ONLY WHEN THEY OCCUR ON THE PAVEMENT SURFACE, AND ENERGIZES ADVANCE WARNING SIGNS. AUTOMATICALLY TURNS OFF SIGNS WHEN THESE CONDITIONS NO LONGER EXIST.

NOTE:

MOISTURE AND TEMPERATURE SENSORS MOUNT IN, AND BECOME PART OF, THE SURFACE ON WHICH ICE, SNOW, OR FROST IS TO BE DETECTED.

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R1254 RAMPSIDE PICKUP .

K1534 4-WHEEL-DRIVE FLEETSIDE PICKUP

C1416 CARRYALL .



JOB-MATCHED CHEVROLET TRUCKS FOR '62

NEW POWER! NEW EYE APPEAL! CHEVIES FOR EVERY CHORE

From Chevrolet's broader-than-ever 1962 lineup of trucks for every kind of hauling job comes a full roster of better-than-ever light-duty models, specialists at trimming tough jobs down to size in short order. Here are new models and new power choices to meet a wider range of working needs, plus a trim new look for all conventional models that gives you safer seeing down the road! Now it's easier than ever to get Chevrolet's traditional thrift and dependability going for you, in the model tailor-made for your kind of job. There are work-loving pickups in a full range of sizes and weight ratings, in sleek Fleetside and handy Stepside styles, plus sensational Corvair 95 Rampside and Loadside models built to outwork anything in their class. In addition, there's the biggest choice ever of choice delivery models, including smart, fleet-stepping panels, high-capacity Step-Vans for every job up to 10,000 lbs. GVW, and the wonder-working Corvair 95 Corvan. For specialized requirements there are sturdy stake models and chassis-cabs in every size and weight class, rounding out a selection sure to include a better way to do your job! Why not see your nearby Chevrolet dealer for full details on the model made for you, and start finding out right away how much better business can be. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

NEW EASY-VIEW STYLING—For 1962, all conventional pickups, panels and Suburban Carryall models ride in with trim new look-ahead lines, featuring a new hood design sloping lower at the front to let you see the ground as much as 8½ feet closer. Safer, easier viewing results! Also, there's a handsome new grille, new custom exterior trim, and sparkling new colors. Inside, too, things are looking better for the man at the wheel, with new easy-to-live-with colors and tough good-looking upholstery.

NEW STEP-VAN 7—Here's good news—211 cubic feet of it!
—for light-duty delivery operators with high-bulk lading problems. And Chevrolet's new Step-Van 7 is built to give your bulky loads a better ride, too, on the years-ahead Independent Front Suspension chassis design that's revolutionized the conventional truck field. With the big-saving High Torque 235 Six under the engine box, there's plenty of power to take your tightest schedules in stride, and a long list of better built body features adds up to easy work and extra-long working life.

NEW HIGH TORQUE POWER—New wider power choice for '62 lets you match your job needs better than ever, in all conventional pickup, panel and Carryall models. There's the standard-equipment 235 Six, cornerstone of the Chevrolet reputation for unbeatable operating economy, and the spirited, ultra-efficient 283 V8 for premium payload punch. And now, in addition, the heavy-duty 261 Six is available at nominal extra cost, offering an extra measure of stamina and durability to keep on delivering in the roughest, toughest kind of duty.

JOB-TESTED CORVAIR 95's—They've got a year of enthusiastic acceptance behind them and they're still the talk of light-duty trucking! Chevrolet's sensational Corvair 95 models, in two pickup styles and the spacious Corvan, have set new standards for space and weight utilization in the half-ton field. With a roomy driver compartment up forward and the compact, perky 145 Six tucked under the load floor at the rear, the space between goes to work in a way conventional designs can't match. And, to top it off, this new way to work comes in as pretty a package as ever came down the pike!

YOURS FOR THE ASKING ... FREE INFORMATION

Use this convenient ordering coupon to get descriptive literature and specifications on new 1962 Chevrolet trucks to match your job. Just check what you would like, fill in your business address and mail to: Chevrolet Motor Division, P.O. Box 7271, Detroit 2, Michigan.

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7. Medium- & Heavy-Duty	Address
Models	Address
8. Diesel-Powered Models.	0.0
9 Tandem Avie Models	City

Title			
Company	-		

City Zone
County State









1962 CHEVROLET JOBMASTER TRUCKS







NEW ON AMERICAN WATER METERS . . .

TELEREAD remote reading systems now bring water meter reading out in the open

Here is an entirely new concept in water meter reading. Whether the customer is at home or away, *every* meter is read *on time*. Water consumption figures are complete every billing period.

The new TELEREAD increases each man's productive reading capacity. Doorbell waiting time and call-backs are eliminated. The large easy-to-read dials on the "Read-out" unit increase reading speed and assure accuracy. The unit, about the size of a flashlight, is plugged into the outdoor receptacle . . . and there's the reading. It's as simple as that.

Customers, too, welcome the modern TELEREAD method of meter reading. The hazard of admitting strangers under the guise of a meter reader is over. Household routine is not interrupted. Staying home on meter reading day is no longer necessary. Disagreeable company-customer relationships created so often by old fashioned meter reading are a thing of the past. Worry-free, trouble-free water service that builds good will, becomes a reality.

- · Faster... Easier... More Readings per Day
- No added Mechanical Load on the Meter to Impair Accuracy
- · Low-Cost, Maintenance-Free Installation
- Eliminates Call-Backs

- Same Dependable AMERICAN Water Metering Accuracy
- Builds Better Public Relations
- Entire Installation is Weather, Water and Dust-Proof

Let us send you complete cost-saving information. Mail handy coupon today.

BUFFALO METER COMPANY, INC. 2920 Main Street, Buffalo 14, N. Y.

Yes, we are interested in the new TELEREAD Method of Water Meter Reading. Rush complete information.

Name Position

Company

Address

City Zone State

SUSSIDIARY	BUFFALO METER COMPANY, INC.
AMERICAN	2920 MAM STREET . BUFFALO 14, N.Y.
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MULTIPLE PASTION DESCRIPTION OF THE PURPOSE PROSE



Sanitary Landfill A PAYLOADER can dig the trench, spread and compact the refuse, corry and spread cover dirt.

Blacktop Loading is a fast, efficient PAYLOADER task — from either piles or windrows.

Sweeping Pick-up Sweeper attachment is valuable for general sweeping, also for recovery of excess sand after topping.





PUBLIC WORKS for November, 1961

ASSURES A FULL WORK LOAD ALL YEAR

When you invest in a PAYLOADER you can be sure that you can keep it busy and productive every month of the year. That's because it has all-season 4-wheel drive traction and can move quickly to and from work sites and between job assignments. And most important of all is its proven versatility or work-ability — the many kinds of jobs it can do.

In fact the record of versatility and accomplishment and reliability established by PAYLOADER units in public works service through the years is a long and enviable one. So much so that many experienced public works officials consider them almost as important as dump trucks in their equipment pools.

A PAYLOADER tractor-shovel has an even greater tax-saving potential for construction and maintenance operations when consideration is given to the many optional attachments available for it, such as:

Drott "4-in-1" Bucket—greatly expands the variety of jobs a PAYLOADER can do—enables it to pick up small piles cleanly; to grasp, move and load slabs, curbstones, stumps and logs; to strip sod, grade or to bulldoze.

Wain-Roy Backhoe, Rotary, "V" and Blade Snow Plows, Ram Pick-up Sweeper and Ram Blacktop Spreader, are some of the other optional attachments that can pay extra dividends to the public body owning a PAYLOADER.

Your PAYLOADER Distributor with his long experience in the application of rubber-tire tractor-shovels — and with the most complete and most proven line — is ready to help you select the size and model that best fits your particular needs. He also has the finest service and parts facilities in the industry, backed by Hough field service personnel.



Snow Fighting Load it out with a bucket or plow it with Rotary, "V", or Blade plow attachments.



Ditch Maintenance PAYLOADER with regular or "4-in-1" Bucket, or Backhoe can dig and clean out roadside ditches.



Pavement Removal is a common PAY-LOADER job, with or without prior breakage, depending on condition of old pavement.



Land Clearing PAYLOADER, with "4-in-1" Bucket — a popular combination for grubbing, clearing, loading stumps, trees, stones.



Trenching PAYLOADER with Backhoe attachment can dig trench, handle pipe and fittings, backfill, load excess dirt.



Clean-up — either routine or emergency
— is a PAYLOADER "natural" as it can
go anywhere it's needed in a hurry.

HOUGH.



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LIBERTYVILLE, ILLINOIS

SUBSIDIARY — INTERNATIONAL MARVESTER COMPANY



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Mill Creek Adds FOURTH IDEAL GENERATOR!

Cincinnati's new Mill Creek Sewage Works—one of the nation's finest—has recently installed the fourth Ideal 1350 KW A.C. generator, boosting plant capacity to 120,000,000 GPD.

Designed for optimum efficiency in producing electrical power, Mill Creek incorporates a total of 4 Ideal, 1350 KW, 4160 volt A.C. generators that supply the sole power for this station's pumping, comminution, flocculation, digestion and building lighting.

Ideal low and high speed A.C. generators, from 10 to 10,000 KW, are designed and engineered to meet your most exacting requirements. A nation-wide organization is at your service to help you with the planning and application of your next power project.



For complete information call your nearest Ideal Sales Office or write for Bulletin 510, Low Speed Generators and/or Bulletin 505, High Speed Generators.

ELECTRIC

AND MANUFACTURING COMPANY 614 East First Street Mansfield 3, Ohio, U.S.A.

GENERATORS, MOTORS AND CONTROLS

Ed Cleary comments on:

Some New Facts For Forecasting Industrial Water Needs

EDWARD J. CLEARY

Diplomate, American Academy of Sanitary Engineering Cincinnati, Ohio

FORECASTS on the future water needs of industry might require considerable revision downward—as much as 50 percent—using some facts presented at the recent Southern Water Resources Conference in Richmond, Va. The conference is an annual affair that brings together the top men of thirteen states in the Southeast who are responsible for shaping policy decisions on water quantity and quality management.

Not the least of the factors affecting such policy decisions in the industrial-growth minded south is an estimate of the future water requirements of industry. Accordingly, the conference invited viewpoints from three major industries—textiles, chemicals and paper manufacturing. What these industry spokesmen reported not only should influence the thinking of water-resources administrators in the south but likewise commands the attention of all who are involved in making projections of future water needs.

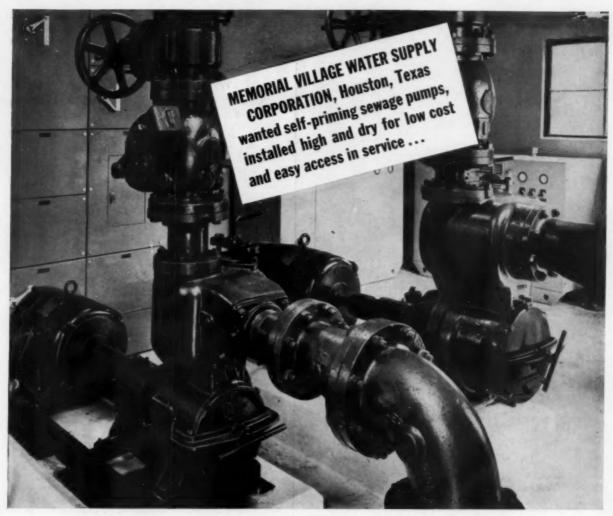
In brief, it appears that per unit of production the water requirements of industry are being drastically reduced as a result of technological changes and conservation practices. And it is suggested that even greater reductions will be achieved when economic considerations and other incentives arise to justify further curtailment of water use.

Pulp and Paper Experience

Speaking for the paper industry, Fred V. Doutt of the Champion Paper Co., Canton, N. C., agreed that the future must be judged by the past. But he cautioned that in reviewing the past, the selection of bench marks is difficult.

"The Kerr Committee (Senate Select Committee on National Water Resources) report on water needs for 2000 A.D." said Mr. Doutt, "may have picked the wrong bench marks. They expect a population of 350 million and this may be correct; but they expect each of these persons to require 1,680 pounds of paper compared to 420 pounds today. One other projection suggests a paper demand of 3½ tons per capita. To these figures they assign a water requirement of 47,000 gallons per ton. These figures produce a water requirement that is all out of reason."

Mr. Doutt then cited 25,000 gallons as a more realistic value. And he reported that one of the newest mills required only 12,000 gallons per ton of paper and was expecting to reduce this. He pointed out that as water supplies become more valuable, the economic incentive to re-use water will lower the water demand per ton.



ANOTHER MODERN SEWAGE TREATMENT PLANT INSTALLS GORMAN-RUPP HIGH-AND-DRY PUMPS



This electronically-controlled Texas plant includes 4" and 6" Gorman-Rupp sewage pumps, Models 14A2 and 16A2 respectively.

They are self-priming. They handle solids, up to $2\frac{1}{2}$ in the 6' pump. They have quick-removable endplates for fast, easy cleanout. They're installed high-and-dry, not down in a pit, for low first cost and easy service. And they're built for dependably continuous operation and rock-bottom maintenance costs.

Advantages like these are perfect for the highly modern Memorial Village sewage plant. As illustrated, the pumps are driven by woundrotor electric motors. Operating speed is governed by electronic-sensing, flow-matching controls. The 4" pump operates from 1900 rpm down to 1100 rpm, and the 6" pump from 1200 to 600 rpm. Operating rates vary from 1800 to 50 gpm, controlled entirely by the rate of incoming sewage. Heat exchangers on suction pipes keep liquid in the flow-matchers at controlled temperatures.

Just remember—in any sewage treatment plant—Gorman-Rupp pumps give you maximum on-the-line dependability at minimum overall cost. See your authorized distributor or write us direct.

THE GORMAN-RUPP COMPANY

305 BOWMAN STREET MANSFIELD, OHIO GORMAN-RUPP OF CANADA LTD., ST. THOMAS, ONTARIO



FRINK Reversible PLOWS LEFT, RIGHT OR STRAIGHT AHEAD

trip blade saves wear and tear, even on roughest roads

Here's why sturdy Frink Reversible Trip-Blade Sno-Plows give you all-round plowing versatility... meet almost any snow removal problem.

Frink Reversibles plow left or right for in-city maneuverability...bulldoze straight ahead for clearing intersections, bridges, lanes, parking lots, airport ramps and wide sidewalks. Cab-operated power hydraulic unit automatically angles plow 10, 20, 30 or 37 degrees left or right, even while truck is moving! (Manual reverse also available.)

And heavy duty Frink construction takes roughest operating conditions in stride, slashes your repairs and overhead. Preloaded trip spring mechanism with unique moldboard linkage follows road contour, glides plow over obstructions, quickly returns to normal plow position. Scuff shoes protect #10 gauge steel moldboard from curbs and side obstructions.

For complete details on versatile Frink Reversible Sno-Plows write Dept. PW1161



At his own mill Mr. Doutt said that water use today is 16 percent less than in 1937, while production is $3\frac{1}{2}$ times as much. "One gallon of fresh water is now doing the work that 4 gallons did in 1937."

What's Happening in Textiles

Water-conservation practices in a textile mill can reduce requirements by at least 25 percent and in some cases as much as 50 percent. This was the conclusion of T. A. Alspaugh, Cone Mills Corp. of Greensboro, N. C.

"In the textile industry most washing operations seem to operate on the theory if a little water does a good job then ten times that amount does an excellent job," said Mr. Alspaugh. By using meters and making changes in the design of washing equipment it was possible to make substantial reductions in water use. For example, in a bleaching operation that formerly required up to 15,000 gal. per 1,000 lb. of goods the water requirement was reduced to 3,000 gal.; even more spectacular has been the reduction of water for dyeing operations where 1,000 gal. of water will suffice for what formerly required up to 36,000 gal.

Mr. Alspaugh also pointed to further opportunities for water conservation by re-use. The cold washes from many processes in a textile mill can be used for cooling purposes, and cooling waters from compressors and air-conditioners can then be returned for other process use.

Use Versus Consumption

In the chemical industry the optimum economic balance of water usage is constantly under scrutiny, and this focuses attention as conservation practices, according to Robert B. Balmer, of the E. I. du Pont de Nemours Co. of Wilmington, Del.

Closed cooling systems, such as those employing cooling towers, can use the same water twenty times or more. A technological change that will have an impact on further conservation of water is the practice of direct air cooling, which is coming into more common use, said Mr. Balmer. "As water becomes more expensive, the optimum economic balance of use will shift and additional conservation measures may become justified," he said.

With regard to water requirements, Mr. Balmer made a distinction between use and consumption. He said that in chemical plants about 90 percent of the water intake is discharged back into streams, and only 10 percent is evaporated, goes into the product or is otherwise consumed. Virtually all the water returned to streams (88 percent) has been employed only for cooling purposes.

National Trend is Downward

Further evidence that industry in general has become water-conservation minded was the announcement of a finding soon to be released in a report by the U. S. Department of Commerce. This was made by James Owens, acting director, of the Office of Industrial Materials, Business and Defense Services Administration, who was the dinner speaker at the Southern Water Resources Conference.

Mr. Owens reported that the use of water "per dollar of value added to a manufactured product" had shown a decrease—from 21 gallons in 1954 to 12 gallons in 1959. This decrease of almost 50 percent that has been registered in a wide variety of manufacturing establishments matched almost precisely

STEEL DRAINAGE PIPE FLEXES WITH THE FILL



whale of a difference in the design of a drainage system! You get that flexibilitywith-strength only in pipe made with corrugated steel.



Drainage pipe made of corrugated Beth-Cu-Loy (copper-steel) sheets may look thin enough to crumple under heavy loads. But it can be thin because it has steel's strength—and its very thinness gives the pipe transverse flexibility.

Flexibility, in turn, lets the structure use the surrounding material to help support loads. The stress tends to be peripheral, rather than vertical.

With its heavy coating of zinc, Beth-Cu-Loy drainage pipe is durable. Pipe of this type often lasts 40 years and more. It is light enough for easy handling and installation. Pipe joints can be quickly made in the field, with no time lost for setting and curing.

If you would like full details about Beth-Cu-Loy sheets for drainage structures, your local pipe fabricator can give them to you. We'll be glad to furnish you with the name of a fabricator near you.



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Ferri-Floc, a superior coagulant, can eliminate your water purification problems—Coagulation, softening, removal of iron and manganese and other problems encountered in water purification. Our consultants are thoroughly qualified to assist you in producing purer water and would be pleased to come to your plant.

Let us send you more complete information on Ferri-Floc.

Also basic producers of-

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the situation previously reported by spokesmen for the textile and paper industries. This was a significant coincidence because Mr. Owens had no advance knowledge of what had transpired when he offered the data revealing the national trend with regard to water use.

Chairman of the conference, Sam A. Thompson, who heads the Mississippi Board of Water Commissioners, summed up the feelings of many delegates when he closed the meeting by saying: "We've got some important new information to ponder as we go forward in planning future water-resources developments."

Expressway Construction and Water Distribution in Chicago

Construction of the Congress Street Expressway in Chicago was completed during 1960. The water main adjustments, made necessary because of this expressway construction, have also been completed. A total of 45,777 feet (8-7 miles) of water mains (4-inch to 36-inch) were installed and 74,514 feet (14.2 miles) were abandoned, a resultant decrease of 28,737 feet (5.5 miles) of mains in service, because of water main adjustments made necessary by the construction of the West Route Expressway (Congress Street). A total of 1720 structures were wrecked and an equivalent number of water service pipes for these buildings were taken out of service.

Construction of the Northwest Route Expressway has been substantially completed. Water main adjustments for the Northwest Expressway began in 1956 with the start of the expressway program. During the interval between 1956 and the end of 1960 when the expressway was substantially completed, a total of 83,425 feet (15.9 miles) of water mains (4-inch to 48-inch) were installed and 147,675 feet (28.1 miles) were abandoned, a resultant decrease of 64,-330 feet (12.2 miles) of mains in service because of water main adjustments made necessary by the construction of the Northwest Expressway. A total of 2426 structures were wrecked and an equivalent number of water service pipes for these buildings were taken out of service.

Parking Lot Using Compacted Snow

The Polar Division of the Naval Civil Engineering Laboratory served as snow-compaction consultants to Detachment ALPHA, MCB-10, for the Olympic games at Squaw Valley, California. An area of approximately 80 acres of compacted snow was opened to parking on 14 February and used continually until the end of the Olympic Games on 28 February, 1960. In addition, a one-mile snow road 100 feet wide was completed on 19 February and opened to traffic on 20 February. During the 15-day period of use, some 60,000 cars were parked on the lot. Daily parking ranged from 1,260 cars on 14 February to 10,500 cars on 21 February. The snow road was trafficked over 100,000 times during the games. A 1/4-inch thick sawdust cover over the compacted snow served as an insulator on high-temperature days and aided traction. It also caused formation of a 2 to 3-inch ice layer at the snow surface, which prevented deterioration of the snow by traffic. Daily maintenance of minor surface damage and snow resawdusting of areas was necessary. Even so, the parking areas and snow road were operational at all times. These data are from "The Navy Civil Engineer."



new Badger Easy-Read

You're looking at the life-size face of the new Badger Easy-Read magnetic drive meter. Its biggest-face-in-the-industry (1/4" high digits) is just one of Easy-Read's exclusives. Here's more:

SEALED, REMOVABLE REGISTER - Off comes its head without even disturbing the meter in the line. Easy-Read's register and cover can also be mounted in any of four positions for most convenient reading. Register and gear train parts operate in a clean, dry, lubricated, sealed housing to forever eliminate fogged registers.

TRULY PERMANENT MAGNETIC COUPLING - Easy-Read's ceramic magnets are made of high-quality barium alloy material - rustproof, noncorrosive, proven truly permanent. No stuffing box needed.

INTERCHANGEABLE PARTS - If yours is a Badger meter system, many parts in the new Easy-Read are interchangeable with the parts in your present meters.

Ask your Badger representative soon for a demonstration of the new Badger Easy-Read magnetic drive meter.









Split-case Easy-Read meters %" through 2"

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4545 West Brown Deer Road . Milwaukee 23, Wisconsin

Municipal Power

Electric House Heating

Electric utilities which are experiencing a differential between summer and winter peak loads due to increased use of air conditioning equipment may find that promotion of electric space heating will balance demand.

BRUCE J. ENNIS

Associate,
Burns & McDonnell Engineering Co.,
Kansas City, Missouri

S TARTING in the year 1953, many electric utilities in the Midwest experienced for the first time a summer peak load which was higher than the winter peak. This effect, caused largely by the coincidental demand placed on the systems by residential and commercial air conditioning equipment, was part of a general trend in such higher summer-time loads spreading from the southern states up toward the Canadian border. In subsequent years, this trend has become accentuated throughout much of the country, creating an unbalance between seasonal power demands, reducing the annual system load factor, and subjecting outdoor distribution equipment to maximum duty requirements during the hot summer months when ambient temperatures are most restrictive to loading capabilities.

On one typical system, the summer and winter peaks were essentially equal in 1952, and the annual load factor was 56 percent. In the year 1953, the summer peak exceeded the winter peak by 1500 kw, and the load factor fell off one point, to 55 percent. Since that time, this differential has increased so that the winter peak is now only 83 percent of the summer peak, and the annual load factor has dropped to 49 percent.

Expressed in concrete terms, the generation and distribution system capacities required to serve the summer time loads are now 20 per cent, or 12,000 kw greater than the capacities utilized by the winter peak loads. At an average value of the electric plant in service of \$270 per kw, this 12,000 kw represents an investment of \$3,240,000 in phy-

sical properties which are capable of serving the system consumers and of producing revenue, but which are not being utilized fully during eight or more months during the year.

In order to offset this growing differential between summer and winter peak loads, to improve system load factor and year-around utilization of electric plant properties, and to increase annual revenues for maximum operating economy, an increasing number of utilities faced with this situation are actively engaged in the promotion of electric space heating, especially with reference to residential heating. In the case of the typical system cited above, and assuming a heating load demand of 12 kw per home, a resistance heating saturation of less than 4 percent of the total number of residential consumers would increase the winter-time demand by 12,000 kw, to equal the summer peak load and provide maximum utilization of the system's generating and distribution facili-

Electric house heating is rapidly gaining in acceptance. With increasing knowledge in the application of house insulation materials and technical experience in the use of new heating equipment, electric heating offers the advantages of convenience, cleanliness, safety, space saving, individual room temperature control, the absence of noise and fumes, and other values at costs which are competitive in many areas of the country.

For effective and economical electric heating, it is essential that the house be provided with thermal insulation such as batts, blankets and loose fill materials, to reduce the amount of heat that escapes by transmission through walls, floors, and roofs. Storm doors and windows are desirable to reduce heat transmission losses and the infiltration of cold air, especially in the

colder climates. A house may be insulated so that it will require only one-third of the amount of heat required for an uninsulated house.

Among the many types of electric house heating equipment which are now available, the principal types are as follows:

Baseboard Heater: These electric heaters are installed along the outside wall of each room at the baseboard level. Various designs permit wiring from the back, the bottom, or the ends of heater sections.

Ceiling Unit: In this type of heat source, electric heating cable is looped back and forth in new plastered ceiling, or in plaster newly applied over existing ceilings. The length of cable and spacing between loops are coordinated with the area of the ceiling surface and the amount of heat to be put into the room to replace heat losses.

Central Furnace: This type operates as a conventional heating system and consists of electric resistance heating elements, a fan to blow the heated air through ducts, and thermostatic controls to energize one, two or more of the heating elements as heating requirements dictate.

Floor Furnace: Electric furnaces may be installed in the floor and covered with a grill to permit heat from the resistance elements to rise into the room by convection.

Wall Unit: This type of unit is designed for recessed or surface wall mounting and is provided with a grill-guard. It may be equipped with heating panels of either the radiant or convection type. Similar heating units, of the portable type, are useful for supplemental and spot heating.

Heat Pump: A heat pump is an air conditioning system utilizing refrigeration equipment to heat the home in winter and cool it in summer. In the summer-time cycle, the refrigeration process removes the heat from the rooms in the



Jetmore, Kansas, selected another heavy duty ENTERPRISE Engine based on ten years experience.

"Because we have such a wide variation in loads and operate at a load factor of only 45 per cent," said Emery C. Graves, Utilities Superintendent, "we decided on a Tri-Fuel Enterprise. From our past experience we found that the exceptionally low cost of operating an Enterprise at such a low load factor is outstanding."

Operating at a cost of only 3.55 mils per KWH, based on lube oil cost of 70¢ per gallon and natural gas at 22½¢ per MCF, the City of Jetmore's new Enterprise produces 12,570 KWH per gallon of fuel.

There's an economical, heavy duty ENTER-PRISE Engine for every municipal, co-op or industrial use—for electric power generation, sewage plant power, pumping systems—from 73 to 7703 HP. Available in diesel, dual fuel, tri-fuel or spark ignited gas. Call or write today for full information.



ENTERPRISE SINGUISS

Power Division of General Metals Corporation



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house and dumps it outdoors, in the same manner in which a household refrigerator absorbs the heat from food stored in the cabinet and "pumps" it into the kitchen. Conversely, in the winter-time cycle, the refrigeration process is reversed and heat from the outdoor air is brought indoors to heat the rooms in the house. Additional resistance heating elements may be installed in the unit for supplemental heating during very cold weather when the outdoor air might lack sufficient heat to supply the heat pump adequately.

Thermostat Control: In general, each room in an electrically heated home is controlled by its individual thermostat. This permits the maintenance of cooler temperatures in sleeping rooms from those in living rooms and other areas.

The amount of heat put out by an electric resistance element varies as the square of the operating voltage. Such a unit, rated 1000 watts at 115 volts would produce 3413 Btu of heat per hour while operating at its rated voltage of 115 volts. If the operating voltage were to be reduced to, say 110 volts, the heat output would drop to only 3123 Btu per hour, and the power consumed would decrease from 1000 watts to

915 watts. Because of this characteristic it is necessary that supply system voltages be maintained at adequate levels to keep the electrically heated house at comfortable room temperatures.

While it is a matter of overall system economics to promote winter-time electric space heating, to offset the summer-time peaking caused by air conditioning load growth, it is equally important that the rates established for heating loads be compensatory to cover all the costs of service. Due to the many advantages of electric heating, the rates need not be as cheap as other types of fuel, although to become effective they must approach competitive costs in the service area concerned. It would not be prudent to offer an uncompensatory rate for electrical heating service primarily for the purpose of building up winter-time loads to compensate for summertime peaks. At some future date, the situation might be reversed, and winter peaks might dictate the need for additional generation and distribution system capacity, over and above the requirements to serve summer peaks, even though the cost of producing and distributing a kilowatt-hour of heating energy ex-

ceeded the price that might be charged therefor by an un-compensatory rate schedule.

Rather than setting a separate meter on a house to measure the energy required specifically for electric heating, a study should be made of existing residential rate schedules with a view toward the consolidation of billing through one meter for all electric service consumption in a given home. This might entail a readjustment of the last energy block in the rate schedule, the establishment of a new rate schedule with effective billing month dates separated into: (a) June through September; and (b) October through May; or an equivalent rate structure designed to provide equitable and adequate compensation for electric heating service under present and possible future system annual load cycles.

In the promotion of electric house heating sales, the utility might engage in newspaper advertising, personal calls, handout literature, and other forms of advertisement and prospective consumer education. Other promotional sources lie in cooperation between the utility and contractors, architects, and storm door and insulation dealers. 000

NOW PLOWS



V-PLOWS-from 8' to 91/2' swath nose heights 30° to 54°.

WINGS-10' to 12'-partial or complete hydraulic control.



STRAIGHT PLOWS-reversible -9' to 12' lengths - heights from 29" to 60".



TAPER PLOWS-9' to 12' length of cutting edge-full range of heights and adjustable or one-



RIGHT-V-LEFT-hydraulic control in cab converts right-hand taper to "V" and to left taper while truck is in motion.

PLUS CUSTOM DESIGNS AND SIZES TO MEET EVERY POSSIBLE REQUIREMENT

THE GLEDHILL ROAD MACHINERY CO. ers of the plow with the perfect meldbeard GALION, OHIO

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Anthrafilt stands alone as the one Filtering Medium that is best for all types of filters!

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offers important advantages over sand and quartz DOUBLES length of Filter runs . REQUIRES only half as much wash water • KEEPS Filters in service over longer periods • IN-CREASES Filter output with better quality effluent . GIVES better support to synthetic resins . PROVIDES better removal of fibrous materials, bacteria, micro-organic matter, taste, odor, etc. • IDEAL for industrial acid and alkaline solutions • EFFEC-TIVE filtration from entire bed . LESS coating, caking or balling with mud, lime, iron, or manganese.

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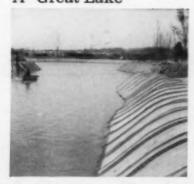
ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Bldg., Wilkes-Barre, Pa.

Lick berm erosion quickly - cheaply with Careymat Liner



For 1/3 to 1/2 the cost of concrete, the Kansas State Highway Department protected the embankments of this overpass from erosion with Careymat Liner.

A "Great Lake"



Careymat is ideal for water containment in ponds, reservoirs and canals. This partially-filled basin is one of the "Great Lakes" in Freedomland, U.S.A. More than 420,000 sq. ft. of Careymat line these lakes, holding 20,000,000 gallons of water.

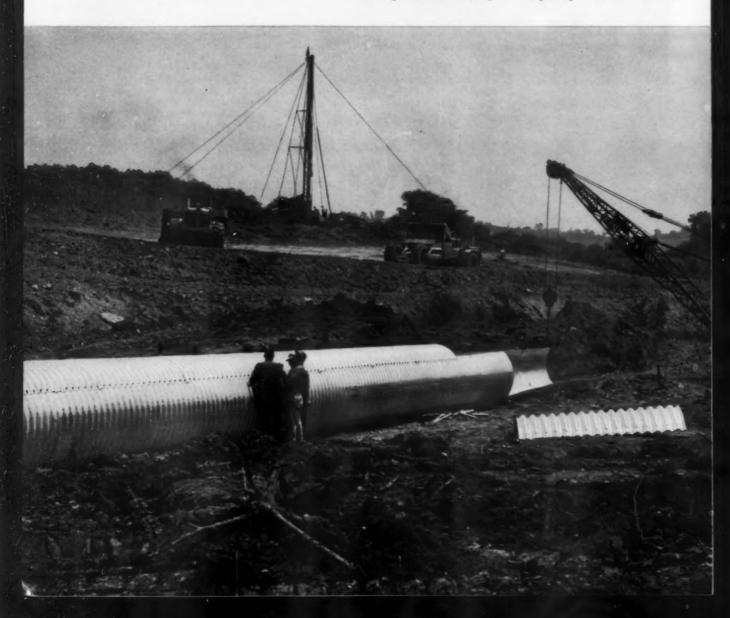
Fast, simple installation: Highway maintenance crew spiked flexible Careymat sheets to the slope, overlapping top and bottom. Sides were butt-jointed and sealed with batten strips. The perimeter of the entire installation was turned down and anchored in a 12" trench and backfilled. The surface was then painted with Carey Fibrated Aluminum Roof Coating.

The result: Effective erosion control at a material and labor cost far below other berm-facing methods. Try Careymat on your next bridge job.

For details on Careymat and on application methods, write Dept. PU-1161, The Philip Carey Mfg. Company, Cincinnati 15, Ohio. Carey.

they're building a "runway"

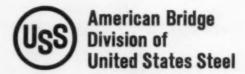
This 840-ft. installation of 60" USS AMBRIDGE Sectional Plate pipe culvert is being built beneath the runway at the Washington, Pa. Airport. It will drain a stream that runs through a ravine under the landing strip. Workmen aren't wasting a bit of time putting it in. All they do is smooth the grade line, lower the plates into place, bolt them together and backfill. Nobody sits around waiting out expensive curing time and nobody had to put up or tear down forms.



under the airport

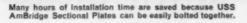
USS AMBRIDGE Sectional Plates are strong. They won't crack or break. They are highly corrosion-resistant because they are fabricated from tough copper-bearing steel, corrugated and zinc coated. They are available in a complete range of sizes and meet all federal and state specifications. Solve your drainage problems with American Bridge Highway Products. Contact one of our offices for literature and information.

USS and AmBridge are registered trademarks



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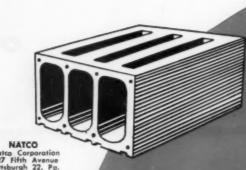
USS AmBridge Sectional Plates are heavily galvanized for long life. Some have been in the ground for 30 years and still look almost new.

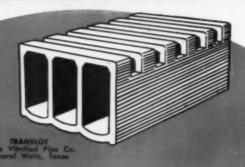
(Left) A crane lowers a USS AmBridge Sectional Plate culvert quickly into place. Backfilling will complete the installation.

Contractor-Indyke Construction Co., Houston, Pa.



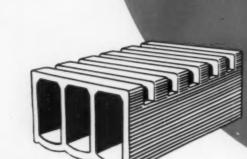
This mark tells you a product is made of modern, dependable Steel.



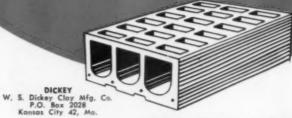


Natco Corporation 327 Fifth Avenue Pittsburgh 22, Pa.

Trickling Filters?

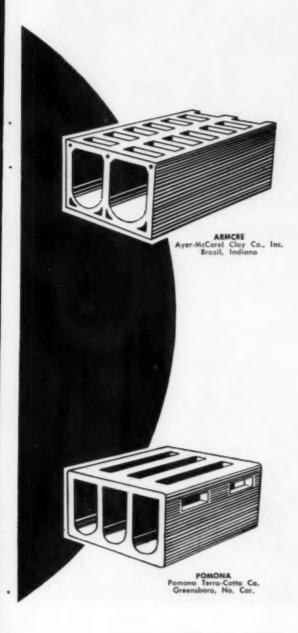


TRANSLOT
Cannelton Sewer Pipe Co.
Cannelton, Indiana



TFFI

The Institute is an organization of seven leading manufacturers of trickling filter floor blocks dedicated to furthering research, development and improvement of vitrified clay underdrains for Trickling Filters.



That more trickling filters have been built in the past fifteen years than all other types of treatment plants is no accident. Sound reasons for this trend lie in the fact that the trickling filter combines durability with flexibility, low initial cost with low operating cost. In addition, those filters built thirty and more years ago are serving well today. With them, too, you can guard against the continuous or unforeseen major remodelings common to some other types. Trickling filters are easily added to when community or industry growth demand expansion.

Many of these advantages are based on their employment of enduring vitrified clay floor blocks in the underdrains.

VITRIFIED CLAY UNDERDRAINS

TFFI Specification vitrified clay underdrain blocks are the best assurance against future trouble in a location where trouble can be big trouble. (Tearing out a "substitute" filter floor that has failed is no fun and less economy). Then any "savings" gained by use of substitute materials are more than lost. Experience has shown conclusively that vitrified clay is the one material with the longest record of freedom from failure under the corrosive effects of acids, alkalis and bacteriological action.

This alone argues against any experiments with failureprone substitutes at merely a lower first cost. This is why the TFFI blocks are now going into 90% of the filter floors compared with 15% some thirteen years ago.

HIGH OR STANDARD RATE BLOCKS

In many areas more high rate than standard rate filters are being constructed. In keeping with this trend, TFFI members manufacture and offer both types of filter blocks, as designing engineers may specify and prefer.

FIRST COST OR TRUE COST?

The only true cost is the final one. Clay outlasts all other materials in filter floors so it under-costs them in the long run. This time-tested proven fact outweighs any temporary savings which might follow resort to less durable materials for the underdrains.

Trickling Filter Floor Institute

Demand CERTIFIED Underdrain Blocks

Vitrified clay block manufactured by TFFI members and tested by the Materials Testing Laboratory of Rose Polytechnic Institute comply with or exceed ASTM Specification C 159-59T. For a copy of these Specifications, see your TFFI Handbook or write nearest member for one.

50-YEAR GUARANTEE

Because their vitrified clay floor blocks are made in modern plants under manufacturing controls of quality impossible with substitute materials, TFFI members offer a SQ-Year Guarantee of their blocks.



Long haul? Short haul? Unusual situations? These problems are the day to day concern of our large and competent engineering staff. Twenty-seven years of continuing research, development and design of systems that save money for those concerned with storage and collection of refuse, has resulted in the largest line of this type equipment in the world.



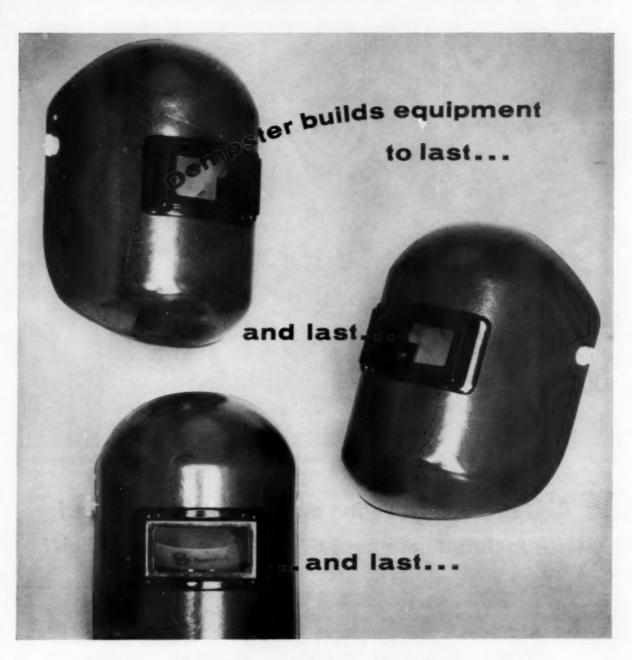


Write Dept. PW-11 for your copy of Catalog Brief 160









How long will it last? This is the question every city official must ask when he buys equipment, because *true* annual cost consists of initial price, plus total maintenance and operational costs, divided by the number of years it retains its efficiency. Many cost-conscious officials know that many pieces of our equipment are still efficient after 25 years of service.

DEMPSTER BROTHERS

KNOXVILLE 17, TENNESSEE

Write Dept. PW-11 for your copy of Catalog Brief 160













The Oklahoma Test Road north of Oklahoma City will eventually be part of Interstate route 35

CONCRETE wins on Oklahoma Test Road with maintenance cost 65% lower than asphalt!

5-year traffic test, ordered by the Oklahoma legislature, confirms again the findings of state highway departments and other official tests. Connecting two-mile sections of concrete and of asphalt, both the best of their type, were built in 1955 on Oklahoma's US 77. For five years beginning Jan. 1, 1956, exact records were kept of all pavement maintenance costs. Total for concrete: \$557.82. For asphalt: \$1,591.87. And not only did the asphalt cost nearly 3 times as much to maintain during the five years—it is already getting its first resurfacing at an additional cost of \$43,753.

Substantial maintenance economy is one reason why concrete is the choice of so many states today. Engineers are designing concrete pavements to last 50 years and more. It's the one pavement that can be designed *mathematically* to meet specific wheel load requirements. It's the only pavement with beam strength and stability.

The Oklahoma Test Road proves again the long-term value of concrete pavements. The first cost isn't just a down payment. Concrete provides true economy for Interstate highways as well as for other heavy-duty roads.

PORTLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of concrete

Complete resurfacing after only five years adds another \$43,753 to asphalt's upkeep!

Despite continued surface maintenance for five years, the asphalt pavement on the Oklahoma Test Road has deteriorated to the point where complete resurfacing is required. The asphalt sections are being overlaid with 1½ inches of surfacing to seal out moisture and provide a new wearing course. When comparison is made, as shown here, on the basis of total upkeep cost, concrete's advantage is dramatic.

CONCRETE

5-year	surface	maintenance	\$557.8
total e	urface u	nkeen	\$557.8

ASPHALT

5-year surface maintenance	\$1,591.87
complete resurfacing	\$43,753.00
total surface unkeen	\$45,344,87

Public Works

Vol. 92, No. 11 NOVEMBER, 19

Versatile Equipment Proves To Be A Good Investment

B. HAROLD FARMER

City Manager, Kissimmee, Florida

F OR THE small city, the key word in equipment purchases is "versatility." Particularly is this true in the small to medium-sized cities like ours (pop. 6,845) where every dollar must do the work of two. We have found that cooperation between departments in picking versatile equipment not only gets the job done, but helps keep our yearly equipment investment down. A good example of machine versatility is a hydraulic aerial tower we bought recently for specialized use. It has proved to be far more useful than anticipated.

Our municipal organization includes most of the standard department functions, such as street, police and fire departments; in addition, we operate a municipallyowned electric system and it was here we felt a serious need for some special equipment. On one particular half-mile stretch of power lines, tree growth became excessive and needed trimming. Investigating various means of maintaining this section, we found that it would cost about \$5000 to contract the trimming job to a private organization. Our own costs for doing the work, using ladders and trimming equipment, added up to a substantial investment in labor alone. Totalling these costs, we decided to purchase specialized equipment and handle the job ourselves.

We decided our best investment would be a hydraulic aerial tower. In May, 1960, we purchased a 45foot Ottawa Strato-Tower, manufactured by the Equipment Division of Young Spring & Wire Corporation. Mounted on a Ford F-600 truck chassis, the Strato-Tower is mobile, and available for use on jobs in about any location. It is especially prepared for work around power lines. The fiberglass crew basket and the fiberglass-coated upper boom are designed to resist 30,000 volts and reduce the danger potential to workmen. Telescopic hydraulic outriggers main-



 THOUGH purchased originally for tree trimming around power lines, the Strato-Tower has proved useful in street light maintenance, including bulb replacement.



TREE-TRIMMING, street lights and power line maintenance take up about 75% of the working time, while "bonus" jobs account for most of the remaining hours.

tain balance while the basket is elevated and an automatic device keeps the tower level no matter on what angle the truck parks. The tower, operated by hydraulic controls, has a continuous rotation feature allowing crews to swing the unit 360° without having to return to "start." In addition to the remote controls in the basket, the unit is equipped with compressed air lines to power working tools at the basket.

Primarily, we bought the Strato-Tower for the job of tree-trimming. On the one job of trimming the half-mile of lines, we found that it half paid for itself in savings. More savings resulted from its use on other trimming jobs around the city. In general, the equipment spent about 75 percent of its working time on this type operation; but other uses began to appear. For maintenance of our mercury vapor street lights, quick elevation appreciably reduced time and allowed repairmen to cover many more jobs in one day than they could formerly handle with such traditional equipment as ladders, scalers and ropes. Regular inspection of transformers becomes easy.

Requests for the Strato-Tower started coming in from other city departments. One area that paid off handsomely was the city "trimming" jobs for special events, Kissimmee has two rodeos, a Boatcade and Christmas decorations to put up each year. Using a five-man crew and two trucks, we formerly spent a week in such decorating. Labor alone cost over \$250. Now, with the tower, we do it in two days with a labor force that costs us less than \$80. Figuring that we decorate four times a year, this is no small saving to a city our size.

As a piece of special disaster equipment, we have a double benefit. The tower is an integral part of our Fire Department which uses it as a regular part of the fire-fighting equipment and finds that it

works out very well. It can maneuver anywhere at a fire site, angling for the best vantage point to work from. With two men and the hose nozzle in the basket, it can elevate high enough to cover a fire in any one of our taller buildings. Our Fire Department likes this operation because it takes the men off a ladder where they can accidentally fall or be blown off during the fire fighting. The tower takes a regular part in fire drills and has become an important part of the fire protection we give our citizens.

After a recent hurricane we found that this highly versatile equipment is invaluable to a city like ours. In clearing the electric lines and high tangle from the storm, we calculated that the insulated Strato-Tower saved enough to pay for half its purchase price.

A specially-equipped unit like this adds greatly to morale of our working crews. In addition, they feel much safer. For example, by accident a crewman recently put the Strato-Tower basket into primary lines carrying 8300 volts to our main business district, breaking the lines. It knocked out the power for a time, but the man was uninjured.

Today, we are able to keep this piece of "specialized" equipment operating about 90 percent of the working hours in the week. Its use by the utility now occupies about 75 percent of its time; the rest is used for "bonus" jobs that occurred to us only after we owned the machine. As for cost, we calculate that the Strato-Tower paid for itself in savings simply by handling the original tree-trimming job that we purchased it for, as well as the hurricane clean-up and decorating for civic events. The remainder is, essentially, "gravy."



• USE IN fire drill illustrates advantages of Strato-Tower in fighting high fires.

Analysis of Water Demand from Meter Records

Use of punched card machine billing permitted correlation of meter-read records with factors affecting rate of water use on peak days, such as lawn watering frequency in relation to the value and age of the house represented by the account.

DAN A. BROCK Department of Water Works, City of Dallas, Texas

T HE RATE of water consumption is significant as it relates to areas of service. We have set up methods to compute area water demands and have found such computations to be useful in analyzing the water distribution system network. In the network analysis, the actual total system water consumption rate must be rationally assigned to take-off points throughout the system.

The methods set up to compute present area water demands are also useful in estimating water demands in proposed real estate developments or other land use. In addition, estimates of rates of water demand will naturally have financial significance as they relate to the water billing rate.

The water use rate of a residential area has generally been estimated on the basis of population: thus the frequent use of gpcd (gallons per capita per day) standards for demand estimation. To make use of this method, the population of such areas in turn require estimation. Further, if widely disparate types of residential development existed, then factors are necessarily applied to the gpcd standard to arrive at an estimate of area demand. Also, factors must be applied to make the base gpcd figure yield an estimate of water demand in other types of urban development. For the past few years, we have been using a different approach to area water demand computation.

When punched card machine billing was introduced in the Dallas City Water Works, our office was offered the opportunity to accumulate water billing information in ways that have engineering usefulness. Prior to that, billing machines were used which accumulated a total dollar billing amount and total consumption. No information was available as to type of occupancy, amount of consumption within consumption ranges, meter size and type of service billed for. Thereupon, commencing in 1955, data on water consumption per month per account was totalled by type of customer (residential, commercial, etc.) in each "meter read book." The meter read book is actually a deck, of mark-sense punched cards. The identity of this book is maintained as basic to control of records. The typical book contains about 250 accounts, and there are about 750 meter read books for our system.

We try to pick for study read books in which the accounts are fairly uniform in type of occupancy: For example, a read book containing 300 residential accounts, the residences being homes 2 to 10 years old in the \$11-17,000 price range and containing not over a dozen non-residential accounts, such as churches, service stations, etc. Of course the areas selected for flow rate study must fit the distribution system to the extent that they can be isolated, and limited to one or two feed main sources. Table 1 shows our account coding definitions.

This work was commenced in 1958, and continuous flow records of from one to six weeks duration have since been made in several locations. The flow rates revealed in these records, when divided by the number of water billing accounts involved, have given us basic flow information. This basic information is the demand in gallons per minute per account, or gallons per

Table 1—Account Occupancy Class Code

Number	Class Title	Class Content
1	Residential	Accounts of single family and duplex dwellings served by %" and %" meters.
2	Commercial	Accounts of commercial enterprises; includes churches, schools, colleges; includes fire hydrant sales; does not include accounts on industrial rate.
3	Government	Only federal, state, City of Dallas, or public school accounts which are exempt from penalty charges.
4	Multiple Tenancy	Accounts of apartments, hospitals, hotels, board- ing houses, etc.; does not include hotels and hospitals on industrial rate.
5	RHD	Accounts of residences served by at least one meter, size 1" or over. If two meters serve a residence, one less than 1" and one 1" or over,
		code both RHD. If both meters are 1" or over, code both RHD.
6	Cities	Accounts of connected cities.
7	Industrial	Accounts on an industrial billing rate.

day per account, of various types of customers in various demand situations: time of day, prevailing weather, etc.

Our gauging stations are portable, and are in use from about June 15 to August 15 each summer. We use four ring-balance circular chart recorders, actuated from pitot rods. The recorders are set to produce a full scale writing pen deflection for each 5 fps velocity.

Certainly many factors influence residential water demands, but in our experience the most important factor, and easiest to evaluate, is simply the price of the home. In Dallas, finer homes have always had larger and greener lawns. Our experience so far in determining demand rates by flow measurements is shown in Table 2, in which the housing classification is compared with peak demand days. The heavier demand figures of higher priced homes stem from their common use of 1, 11/2, and 2-in. meters; our account coding lists these meters as residential heavy demand or "RHD." These larger meters are generally used in conjunction with high demand lawn sprinklers.

Within the customer groupings as set up in Table 2, we do not expect a diversity factor to be significant in the probability sense. In other words, we have set up demand groups which are basically homogeneous. For example, the group \$11-17,000 2 to 10 years old is nearly

Table 2-Demand Rates of Residential Customers

		-	_	-			
Housing	Age and	Peak	Day	Rates.	gpm	per	acct.

0-2	yrs.	2-10	yrs.	Over	10 yrs.
Max.	Min.	Max.	Min.	Max.	Min.
		3/4	1/16	3/4	1/16
2	1/16	11/2	1/16	11/4	1 1/16
31/2	1/4	3	34	21/2	1/4
41/2	36	4	36	4	36
5	1/2	4	1/2	4	1/2
	Max. 2 3½ 4½	2 1/16 3½ ¼ 4½ ¾	Max. Min. Max. 1/4 2 1/16 1½ 3½ ¼ 3 4½ ¾ 4 4	Max. Min. Max. Min. ½ 1/16 2 1/16 1½ 1/16 3½ ¼ 3 ¼ 4½ ¾ 4 ¾	Max. Min. Max. Min. Max. ½ 1/16 ¼ 2 1/16 1½ 1/16 1¼ 3½ ¼ 3 ¼ 2½ 4½ ¾ 4 ¾ 4

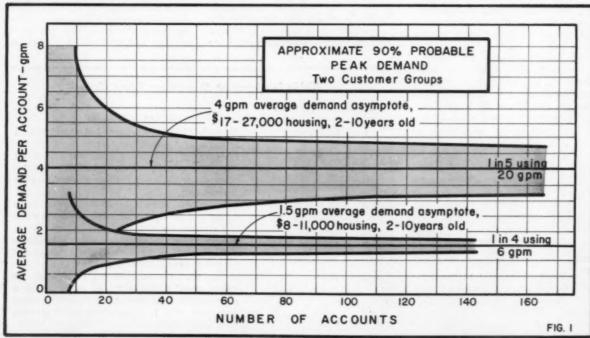
all supplied with %-in. meters on 34-in. service pipe. These accounts can draw an average 12 gpm through two yard faucets. The question then becomes, how many of this group are lawn watering at the year's peak demand hour. If the city-wide average percent of the group which is watering is 25, the over-all group average gallon per minute per account demand is 25 percent of 12 gpm, or three gpm. If we sample accounts at random in this group at the peak hour to see what percent are watering, we know that the first few accounts we encounter may or may not be watering, but as the number checked increases the underlying probability asserts itself, as it would if one were counting the number of heads showing as a coin is tossed. Therefore we are confident, that when as many as 200 residential accounts are considered, their demand will be satisfactorily near the average demand

of their particular class of customer throughout the city. In this way assured, we develop area water demands by applying the gpm-peraccount demand figures, for various types of accounts, in various conditions of demand, against the number of the types of accounts in the area concerned.

Figure 1 shows the approximate 90 percent probable average gpm-per-account demand of two demand categories, related to the number of accounts under consideration. If a test area includes several hundred accounts, then the average gpm-per-account demand figure for the test area will be close to the overall gpm-per-account demand for this type of occupancy in the city as a whole.

Example of Computation

Let us consider the occupancy type, housing value \$8-11,000 2-10 years old. At the peak demand hour



For "Binomial Distribution" relative frequencies see References 1 and 2

AS NUMBER of accounts considered increases, the range of potential demand which is 90 percent probable narrows.

we have established, in a test area of 600 accounts, that the average gpm-per-account demand is 1.5 gpm. We want to assess the variability of this 1.5-gpm figure in samples of this size; we want to know with what confidence we can affix the 1.5 gpm figure to the 20 or 30 thousand accounts of this type in the city as a whole.

For the sake of simplicity of computation and presentation, we will assume that one customer in four is using water at a rate of 6 gpm, or 1.5 gpm average; this will be the most typical lawn sprinkling load in this type of housing. Any particular customer is watering independent of any other customer. If we take for consideration progressively larger groups of this particular class of customer, we need to know the scope of variation of the number of customers watering. For example: We have 10 customers on a block; the overall average lawn watering should be 1 in 4 or 25 percent but we know in fact all 10 could be lawn watering, or none might be lawn watering. For any number of customers watering there is a probability frequency distribution which will tell us the probability of a specific number of accounts watering. When we get upward of 50 accounts into the picture, the probability frequency distribution will approximate the common bellshaped normal curve. But the probability frequency distribution for each and any size sample is exactly the "binomial frequency distribution for the Bernoulli case." (1)

In determining the probability of one, two, three or more accounts out of ten watering, where the underlying probability is one in four watering, this probability is given by the first, second, third, etc. terms of the binomial expansion of (34 + 1/4)10. Tables exist which will give such probability information for samples up to n = 40 in size. For a sample of size 10 the minimum number probability of 1/10 would be that less than one in ten, about 0.8 is watering. The maximum number probability of 1/10 would be that about 4.5 are watering. For small samples the probability frequency distribution is not symmetrical like the normal curve. The actual plots on the curves of Figure 1 are made, considering a minimum of 0.8 and a maximum of 4.5 watering out of 10 accounts at the rate of 6 gpm, as follows:

(0.8) (6)/10 = 0.48 gpm average (low side);

(4.5) (6)/10 = 2.70 gpm average (high side).

The values 0.8 and 4.5 do not show in the table (1); they are a result of rough interpolation. For eight accounts in a sample, we see that there is a 0.1001 or one in ten probability that none are watering (p = 0.25 column, n = 8, x = 0).

For large numbers of accounts we determine the standard deviation of a Bernoulli distribution as follows:

Bernoulli distribution = $(n p q)^{\frac{1}{2}}$, where n = size of sample, p = probability and q = 1 — p.

Consider 500 accounts with p = 0.25 as before; the standard deviation is:

(500) (0.25) $(0.75)^{\frac{1}{2}}=(93.75)^{\frac{1}{2}}=9.7$ Reference to a normal curve table shows that where t is the standard

deviation, $\int_0^{1.28} f(t) dt = 40$ percent of the area under the curve one day from the vertical axis; this 40 percent plus the 50 percent on

the other side makes 90 percent of the area under the curve.

Then 1.28 x 9.7 = 12.4 accounts variation plus or minus off the mean. Since the mean expected number of accounts watering would be one-fourth of 500, or 125 accounts; then 1 time in 10 as few as 112.6 or as many as 137.4 would be watering. As stated above, the frequency curve would be practically symmetrical for this number of accounts. The plots would be:

(112.6) (6)/500 = 1.4 gpm (low side); (137.4) (6)/500 = 1.6 gpm (high side).

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"Operation Cleanup" Yields 4700 Tons of Waste

J. GRADY PHELPS, Superintendent, Division of Municipal Wastes, Miami, Florida

IAMI'S recent Operation Cleanup—a crash program for pick-up of items not included in our regular waste disposal services—netted 4,714 tons of refuse material which had been accumulating, in some instances, for over 30 years.

Our city is a 34.19 square mile area, with 740 miles of downtown, arterials and residential or access roadways, and is the hub of Metropolitan Dade County which claims some one million residents. Additional millions visit this area annually on business, attending conventions, or holiday bent.

City Manager M. L. Reese, whose proposal for the project was heartily endorsed by the City Commission, termed the endeavor as "highly successful."

In fact the undertaking was so well accepted by all Miamians that we are now considering similar drives on a semi-annual basis to coincide with the springtime national "clean-up, paint-up drive" as well as a cleanup just prior to launching our South Florida winter season.

Naturally, a project of this scope needed considerable advance planning, as some 90,000 individual pieces of property were to be involved. It was decided that the problem could best be handled by three successive Monday - Tuesday pickups—because these days were usually our lightest load days—with trucks on their routes from 7 a.m. to 3 p.m. The special pickups were combined with normal collections in each area.

The city was divided into three equal zones—north, central and south. Starting at the northern end of the city limits, the city map was divided into numerical sections. Each of these sections was then divided into four alphabetical areas, beginning at the upper right and rotating counter clockwise. A daily report form listing the areas was used to show the time each neighborhood would be visited by the collection trucks.

With this simple aid, our office personnel could immediately tell any telephone caller when his area was visited last and when the next scheduled pick-up would be made. This, in itself, we found to be an excellent public relations tool.

A week before the pick-up, regular garbage collectors attached a handbill, describing the special drive to a garbage can in each yard they visited. The handbill, designed by a city architect and printed by the city shop, emphasized the advisability of clearing all land of debris before the gusty-wind period of September through November. Residents were advised that coconuts and hazardous tree limbs should be cut and the loose litter discarded.

This clean-up drive was also a fire prevention measure, and residents were urged, in the handbill, to clean out closets and garages as well as clearing their grounds.

All types of discarded materials except soil, rocks and construction debris—that were normally ineligible for regular pick-ups were to be accepted during this special drive.

Four city divisions participated in the drive, under my direction. In addition to our Waste Division, the Parks Division and Streets Division both furnished trucks and personnel for the cleanup drive. The Police Division participated by helping in the removal of junk automobiles from streets and in traffic direction in congested areas.

In all, a total of 18 Hydro and Davis cranes, with clamshell buckets

Operation	Cleanup	Collections	
Section	No. of	Total	

Section	No. of Truckloads	Total Tonnage
North	386	1,276
Central	488	1,495
South	641	1,943
Totals	1,515	4,714

designed for picking up yard rubbish, together with 80 trucks and 200 employees, participated in Miami's first Operation Cleanup in 20 years.

In addition to the regular, threesection crews (north, central and south) we maintained a fourth crew in reserve, a sort of flying squad, which we threw into areas with particularly heavy loads. This enabled our work schedules to be maintained on a regular time basis.

Disposal Methods

Since there was a great deal of metal picked up during the cleanup drive, we enlisted the junk dealers to remove most of this metal to their yards. This was the one difference from our usual disposal methods.

We feel that the success of Operation Cleanup was due in large measure to the excellent cooperation extended our City of Miami Publicity Department by the various media such as press, radio and television.

The Publicity Department, whose operations have brought them many national awards, sent out numerous releases pinpointing the locations of the various pick-ups as well as the dates thereof, together with complete instructions as to what material would be acceptable and how it should be piled for easy and quick removal.

This publicity program resulted in dividends in the form of fewer calls from citizens, a better public understanding of and cooperation in the program, favorable reaction by all media, and the avoidance of having trash sitting out on the curb for extended periods with inevitable scattering of the debris.

The project was not without its humorous aspects. The clean-up brought old stoves, water heaters, washing machines, refrigerators and stacks of venetian blinds—among many other things. Newspaper mounds dated back to 1930 issues in some instances.

One woman sheepishly admitted she had been trying for weeks to get rid of a huge rug by cutting it up in small pieces, week by week, and she finally got rid of the remaining square yardage in one fell swoop.

Other taxpayers registered satisfaction that they had avoided the necessity of paying drayage fees for having this material removed by commercial haulers.



"OPERATION CLEANUP" utilized this Bucyrus-Erie Hydrocrane and a 24-yd, refuse body designed for the city by Pak-Mor.

Anything New in

This survey reveals few innovations in snow removal practice among public works engineers but there is evidence of an increasing interest in new equipment being developed by industry.

SNOW CONTROL?

WILLIAM F. HALLSTEAD

WHEN THE eastern states were finally emerging from the savage snows of 1960-61, the Baltimore Sunday Sun's Curious Camera feature asked this provocative question: "What's your idea of the way to get rid of the snow and keep the automobiles moving?"

This inquiry, put to six citizens at random, evoked six imaginative recommendations. They ranged from a suggestion to use flame throwers to a brief discussion of an "electronic machine" that would vacuum snow from the streets and melt it in a heated tank.

Fanciful and unworkable as these suggestions may have been, they did indicate that a segment of the public was applying imaginative thought to a staggering public problem.

About the time that little curio was published, this writer noticed a remark in the trade press by a public official to the effect that the science of snow removal is "100 years out of date." This led me to conduct a survey of 37 departments of public works and 10 private concerns to help determine this: Are snow removal techniques up to date and is there anything really new and workable in the field?

The results of this mail survey are interesting. A cursory study of the replies reveals a basic 1-2-3 of effective snow removal as a recurrent theme: 1) Salt arterial streets at the beginning of storms; 2) Begin plowing early, before the accumulated depth reaches more than a few inches; and 3) Get the public to use chains or snow tires.

I was surprised at the responses from a number of cities in regions of heavy snow indicating that no ordinances exist therein to declare

emergency routes, enforce parking bans or require chains. Such enforcement is already old hat in some areas not even in the traditional heavy snow belt. The Maryland State Roads Commission, for example, has just been empowered to declare state-wide emergency parking bans and state chain/snow tire routes. With this kind of state-wide driver control legislation in effect south of the Mason-Dixon Line, it is startling to learn that officials in some cities much further north are still wistfully hoping for similar legislation in the future.

Milwaukee's superintendent of street sanitation stated in March, following an 11-inch snowfall, that stalled and abandoned cars nullified 50% of the snow clearance effort. It was estimated that in the wake of this particular storm, 15,000 to

20,000 vehicles were abandoned in the city's streets.

The lament concerning lack of effective control of the public during heavy snowfalls and subsequent clearing operations runs through the survey replies like a chorus of despair. City of Omaha Maintenance Engineer Gene E. Jordan says, "We now have an ordinance requiring effective chains or snow tires but too many people fail to get chains on if snow hits during the day or early evening."

The City of Buffalo Division of Streets lists as a proposal for increased snow removal efficiency that trucking and delivery firms be requested to remain off the streets after all-night snows until they have been cleared for traffic.

The superintendent of the Bureau of Street Sanitation of a Wisconsin



Courtesy Peabody Engineering Corp

● SNOW MELTER under test by New York City has a capacity of 1.25 tens or 10 cu. yds. per minute. Estimated cost of snow removal by melting is 50 to 75¢ per cu. yd.

city reports, "We are presently trying for a compulsory tire chain ordinance and also an ordinance to allow us to move abandoned and stalled cars. I believe the latter to be the greatest single problem in fighting snow storms."

This pointed comment reinforces a statement made some months ago in Public Works: "The greatest handicaps to safe winter driving... are the road users... Without a better degree of cooperation on the part of highway users, little improvement can be hoped for... What is needed is a public relations program, highly educational in nature and intensive as well."

This writer feels that the respondents to his survey will say a heartfelt amen to that. But in view of the survey replies, I would like to suggest that no public relations program is going to be fully effective unless it is backed up by laws with teeth. And I don't mean a law that fines a driver something like \$3.25 to have his car towed from an intersection. That's just an economical towing charge. A fine more like \$25 for obstructing traffic is in order. The segment of the public that will be hurt by stiff fines is the segment which probably would disregard any voluntary program.

Without exception, all the survey respondents who went into detail reported extensive salting and plowing programs. In fact, few reported anything else. The more imaginative proposals for improved snow control techniques came from private concerns. The proposals fell into three categories: 1) In-pavement heating; 2) infrared radiant heating; and 3) snow melting equipment.

In-Pavement Heating

Although subsurface pavement heating is sometimes proposed as a "new idea", the first successful system was installed in 1925 in Rochester, N.Y., when steam was circulated through iron pipes 14 inches below the sidewalk of the Rochester Gas & Electric Company.

This system of heating suffers the drawbacks of corrosion and rupturing pipes due to the freezing of collected condensate. Other heat transfer media have disadvantages, too. Oil solutions present problems of high viscosity and low specific heat, thus increasing installation (pipes must be more numerous) and pumping costs. More volatile solutions such as alcohol can boil and form toxic vapors. Probably the most successful medium is an ethylene-glycol-water solution.





 SIDEWALK along State St., Chicago.
 Top picture shows normal condition after a snow storm. Bottom picture shows result of heating walk with quartz lamps.

The General Services Administration reports that many newly constructed Federally-owned buildings in snow zones are provided with heated pavement, utilizing return condensate, at main entrances and driveway ramps.

The Chicago Department of Streets and Sanitation states that the pavement of the large plaza on the Chicago-Calumet Skyway is heated internally by the same furnace which heats the underground garage facility.

Subsurface pavement heating is used fairly extensively by private concerns in New York. Best & Company on 5th Avenue installed a system 13 years ago. It was of iron piping carrying heated anti-freeze and water, and worked well at the outset, costing about \$1 per hour to operate. But today it is reportedly no longer in satisfactory operation because the pipes have corroded.

Six miles of piping carry heated liquid through the concrete ramps connecting the Port of New York Authority bus terminal with the Lincoln Tunnel. The system can melt about 1 inch of snow per hour.

Many of the small private pavement heating installations use electric heating cable instead of piping. Both systems are relatively expensive, and thus far this high cost alone has prohibited the use of inpavement heating in city streets.

Infrared Heating

The snow control potential of quartz infrared heating is in its bare beginning stage. Long used as an industrial process heating medium, infrared electrical heating is just now coming to the attention of the public. Infrared radiant energy is inherently capable of heating objects rather than the surrounding air. The long thin quartz tube in reflective installations permits a concentration of heat in a desired location.

Some six years ago, the tubular quartz infrared lamp was perfected, providing 6 to 8 lumens of light per watt of lamp in addition to a normal output of 100 watts of heat per inch of lighted lamp. These lamps operate at a 4000-plus degree Fahrenheit filament temperature at full voltage, permitting a higher mounting height than with conventional 1400-1800-degree quartz tubes.

Intended for open-air heating of pedestrians and spectators, quartz infrared lamp installations are proving to have snow melting possibilities. An outstanding installation is found on Chicago's State Street along 10 display windows of Carson, Pirie and Scott, a well-known department store. This is the country's first permanent outdoor installation of quartz infrared heat lamps for shopper comfort. The arrangement consists of 123 1000-watt tubular lamps in reflectors housing 11 to 13 lamps each. The lamps, 13 inches long and %-inch in diameter, are mounted in a single row. The reflectors direct the emanation to the sidewalk in a band extending about 8 feet from the store front. The output is 80 watts of heat energy per square foot at the sidewalk. The lamps are operated at 208 volts and the light level in front of the windows exceeds 500 footcandles. The installation was by the Chicago electrical contracting firm of Hohman and Hill. Inc., with the collaboration of the Commonwealth Edison Company. Though the quartz infrared units were not primarily intended to remove snow, they have done an effective job.

In Allentown, Pa., the Hess Department Store has installed 32 1600-watt General Electric quartz infrared heating lamps in the 9-foot by 20-foot entrance canopy. The canopy is 12 feet above the sidewalk, yet the pavement beneath remained clear during a 15-inch snow December 4th and 5th, 1960.

Twenty-four infrared lamps installed under the main portico of Chicago's Edgewater Beach Hotel provide 40 to 75 watts of radiant heat per square foot at pedestrian level and the installation thaws snow from the walk and adjacent drive.

The Fostoria Corporation of Fostoria, Ohio, states, "It is practical to design an installation to handle the worst possible snowstorm. However, since such storms may occur perhaps only once in 10 years, the question arises whether it is economical to design a system for such a probably rare occurrence."

Fostoria then recommends that applications be separated into three categories: 1) Critical areas, 2) commercial areas and 3) minimum cost areas. The first of these is to be kept free of snow at all times at the rate of three inches of snowfall per hour with a 15 mph wind. The second category would have infrared installations coping with 2 inches of snow per hour in a 10 mph wind. The third category design condition is 1 inch of snow per hour with a 5 mph wind, and this criterion is expected to cope with about 90 percent of snowfalls at a minimum installation cost.

In addition to the Fostoria Corporation, these other firms manufacture infrared fixture equipment: Luminator, Inc., Chicago; Miskella Infrared Co., Cleveland; Radcor, Inc., Bradner, Ohio; Research, Inc., Minneapolis; Ogden Manufacturing Co., Chicago; Southeast Lighting, Charlotte, N. C.; Translite, Inc., Milford, Conn.; Patent Flex Manufacturing Co., Cloverport, Ky. (Others may have entered the field since this list was compiled.)

Although no survey respondent made specific mention of quartz infrared lamps for snow control by public agencies on a large scale, the success of private installations should serve as a stimulus for engineers possessing imagination.

Snow Melting Equipment

The problem of snow disposal can often be as acute as that of snow removal from driving and walking surfaces. Not every city is fortunate enough to have readily accessible snow dumping areas, nor are some prepared to pay the high cost of trucking snow from stockpiles to disposal sites. Adequate disposal of plowed snow on the spot is or would be of considerable benefit to many—but not all—agencies removing large amounts of snow in confined areas.

I have found only two concerns making a major effort in the production of on-the-spot snow removal equipment. This does not indicate, of course, that only these firms are currently working on the problem, but may just be the result of necessarily rapid research on the writer's part.

The Peabody Engineering Corporation, New York City, has a mobile snow melting machine designed to handle 10 cu. yds. of snow per minute. The outside dimensions of the unit, built to operate on city streets, are 8 ft. width, 30 ft. length and 12 ft. height. In operation, snow is loaded into the melting tank where water is injected after being preheated to 160° F in a kerosenefueled furnace. Melted snow is discharged into sewers in freezing weather through hoses attached to the drain outlet.

The Thermal Research & Engineering Corporation, Conshohocken.

Pa., produces three units, stationary, semi-mobile and rully mobile. All of these systems employ submerged exhaust from a high heat release burner. This exhaust is released beneath the surface of the water in the melting reservoir, serving both as heat transfer agent and as adequate agitation of the reservoir's contents.

The stationary system is simply a pit with one or more burners permanently mounted therein. The pit is below grade, and snow can be plowed directly into it. The water produced is run off into the storm sewer through a side drain. The stated capacity for this unit is 25 tons/hr per burner, using No. 2 oil with an electric motor drive. Pit size is 12 to 15 ft. by 7½ ft. with a 6-ft. depth. Water drain-off is 100 gpm per burner. Oil flow is 40 gph per burner.

The semi-mobile snow melter is similar except that the burner and accessory equipment is mounted on a trailer and only the pit is stationary. Thus the same burner can service several pits according to the plowing pattern. Capacities are the same as the foregoing unit,

The fully mobile unit employs trailer-mounted burner, fuel supply, accessories, controls and melting tank, the tank replacing the pits of the previously described models. The unit can be moved along to keep pace with feeding equipment which can be front-end loaders, conveyors or snow blowers. The water is drained off through fire hose to the nearest storm drains or into gutters to flush them or to wash salt off street surfaces. Capacities are the same as in the stationary and semimobile units.

Among the current users of this equipment are the Port of New York Authority, City of Montreal, Alaskan Snow Disposal Service in Anchorage, Logan International Airport in Boston and a number of private firms. A 75 ten/hr fully mobile 2-burner unit will be delivered to the City of New York's Department of Sanitation for trial this winter. This machine, it should be noted, has not yet been purchased but will be used in evaluation tests.

As to operating cost comparisons, the snow melter, according to W. K. Lombard, Thermal Research's vice president and sales manager, offers "a substantial reduction in snow removal costs as compared to trucking operations. An average figure in this regard is a factor of about 1/5th the cost of trucking. Our only operating cost of consequence is the fuel since the unit does not require an operator except for starting it."



Courtesy Esso Research & Engineering Co.

 SNOW melting demonstration by Thermal Research & Engrg. unit which has rated aspecity of 75 tons of snow per hour. Process utilizes 98% of fuel heating power.

Temporary Sewage Pumping Stations

How Phoenix, Arizona, solved a problem in urban growth created by the development of subdivisions which lacked a gravity discharge point into the city sewer system.

ART F. VONDRICK

Assistant Water and Sewers Director, Phoenix, Arizona

THE EXPANSION story of Phoe-nix, Arizona, in the past four years is generally told in terms of square miles of growth, population increase and a \$70 million bond issue. The administration of the planning, design, construction and operation of major facilities is a story of integrated continuity. However, the success and orderly development of the overall sewer expansion program was also dependent on many seemingly minor factors. A significant part of this development was the contribution of a number of temporary pumping stations utilizing submersible pumps. The extension of the trunk sewer lines and intercepting sewers under the bond expansion program was calculated to provide sanitary sewer service to an additional 165 square miles of territory. Trunk sewer construction proceeded rapidly, so rapidly that many citizens commented "all the streets are torn up at the same time." In spite of this hectic construction, new subdivisions always seemed to pop up in the wrong place-beyond existing trunk sewers or on "the wrong side of the hill" from the closest trunk lines.

Septic tank and cesspool installations, as in other areas of the country, had a brief life and to permit such installations would only mean a repeated expense to the homeowners when lateral sewers could be installed. It was obvious that in order to fulfill the needs of the community it was necessary that some means be devised so that the new developments could be provided with sewer service at the outset.

The engineering problems and the economics for the subdivider varied with each situation depending on the size of the subdivision development, the distance from the devel-

opment of the trunk sewer, and whether the development was on the "wrong side of the hil." from the trunk line or merely that "a link" was missing between the development and the trunk line.

The major "missing link" problems were taken care of, for the most part, by an ordinance which permitted developers to finance the construction of the connecting sewer main with a provision for repayment from future connectors on a

pro-rata share basis.

But it remained for the utilization of simple, temporary pumping stations to provide a solution that was acceptable from the developers' point of view as well as fitting the pattern of overall integration of the sewer system. Pumping stations could represent a considerable investment if normal, standard design practices were used. These pumping stations were very obviously to be temporary from a service standpoint; however, whether this was to be a matter of months or years was undeterminable. For this reason alone, it was desirable that the design take advantage of the natural features of the sewer system and incorporate as few as possible extra cost items. It was, likewise, advantageous if most if not all of the extra cost features could be salvable for reuse in future stations. Without too much searching, it was evident that submersible pumps provided many features that could be utilized in a relatively low cost pumping station. Submersible pumps are not new, having been used for many years, although experience with them in the sewage pumping field was limited. Recent developments and improvements in the manufacture of submersible motors indicated that units available possessed acceptable performance and durability characteristics.

Advantages of Submersibles

First of all, the use of submersible pumps would permit the location of the station within the limits of the public right-of-way. Therefore, cost of acquisition of a station
site was not necessary. Likewise,
eliminating motors and other appurtenances from surface location
made security fencing unnecessary.
Most developers question the marketability of any lot that has an
above-ground pumping station in
the backyard.

Adopting a standard size manhole as a pumping pit was desirable; but to do this meant a departure from recognized practice of requiring duplex pumps in each station. A single-pump pumping station sacrificed the advantages of a standby unit in place if pump clogging or breakdown should occur. The absence of a standby unit could be critical since these temporary lift stations would, obviously, be at remote locations in the newer parts of the sewer service area.

On the other hand, the ease of maintenance of submersible pumps, and the simple operation required to replace these units when needed, were points in their favor. Security fences, a small land site, enlarging manholes, etc., may at first glance seem like trivial cost items, however, these costs in each case would be borne by the developer or subdivider. Developers, of small subdivisions especially, in our experience are reluctant to absorb any extra costs not originally anticipated in their pre-financing plans and arrangements.

For these reasons, a single pump submersible-type pumping station was adopted as a standard. At the same time, the disadvantages of a solo pump were for the most part eliminated by acquiring spare pumps for inventory by the City maintenance forces.

A daily routine circuit ride of these outlying stations has proved to be adequate to meet any trouble. The accompanying detail indicates the principal design features of such a typical pump station. This design is by no means how the first one of its kind looked, except for the basic

concept. We have had remarkably little operating trouble and the changes made in the standard details can be regarded as minor refinements.

The manhole is a standard 5-ft. diameter manhole with the exception that the lower portion is deepened to accommodate the pump and provide wet-well capacity. No great care is required to position the pump in the manhole except that the horizontal force main and check valve must be located in the vertical wall of the manhole to permit easy removal of the pump when necessary. The pump is not bolted to manhole floor, but merely rests on its tripod legs.

When such a station becomes abandoned, it is necessary only to fill in the wet-well portion of the manhole up to the invert of the outlet stub initially provided. The manhole then joins the inventory as a conventional appurtenance of the sewer system.

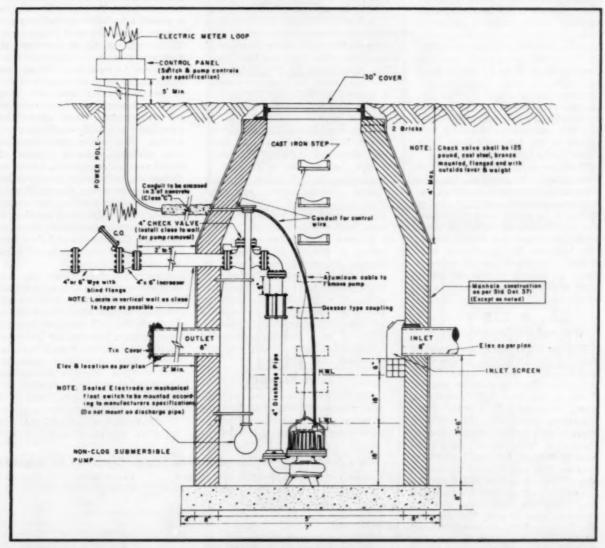
Screens Reduce Clogging

In an effort to reduce clogging problems, pump specifications required units that were capable of passing a minimum of a 21/2-in. sphere size. Pump clogging problems have been remarkably few. In fact, all these instances occurred in one particular subdivision station before the screening device was employed. These experiences led to the development of the "inlet screen" shown on the typical station drawing. These screens are suspended from two cast iron hooks over the inlet sewer. They are effective in this position and are easily removed for cleaning.

Grease clogging has occurred, but has been troublesome only in an area where home garbage grinders are installed in large number. Grease, as well as other interfering substances, has been an important factor in the selection of pump control equipment.

Micro - switches and bare electrodes have been unreliable so that standard equipment is either mechanical type float switches or the sealed electrode type unit.

We are well satisfied with our early decision to utilize the single pump idea. When daily routine turns up malfunctions or abnormal operation, two-way mobile radio communication makes it possible to dispatch a maintenance truck immediately. Standard equipment aboard the truck includes a spare pump, rubber gloves and boots, a manhole harness, a gas engine trailer mounted dewatering pump, and miscellaneous tools. This procedure has



TEMPORARY sewage pumping station for outlying developments consists of a submersible pump installed in a street manhole.

been effective whenever emergencies occur.

The measure of success of these pumping stations is attested to by the record. The first station was put into service in November, 1958, and since that time 10 others have been installed. Of the 11, 5 have been abandoned when gravity connections were possible, integrating the subdivisions with the overall sewer system. One unit was abandoned after only three months service; the longest life has been 20 months. We have served developments with as few as 6 lots and as many as 200 lots, although the average range is 35 to 100 home units.

There has been no difficulty in the application of the various pumping units to the different hydraulic discharge conditions when pumps are transferred or interchanged. Interchangeability was an anticipated necessity and desirability from the start. Therefore, the head-discharge capacity characteristics of all pumps were standardized as much as possible. Various models of pumps driven by 2-hp, 1750-rpm motors generally develop about 20 to 22 feet of head and 200 gpm with maximum size non-overloading impellers. This discharge rating was more or less arbitrarily selected with consideration for maintaining cleansing velocities in the 4-in. and 6-in. force mains likely to be used.

These temporary pumping stations have made it possible for the Phoenix sewer system to absorb expansion problems without undue difficulty, in many cases preventing the installations of tanks and cesspools. Moreover, the lateral sewers are installed in accordance with master planning to permit adjacent areas to benefit in the future in spite of "hop-skip-and-jump" subdividing.

Wet and Dry Weather Flows

The annual report of the Department of Public Works of the City and County of San Francisco, Calif., gives the following data for sewage flows at the Nort Point treatment plant. Average dry weather flow, excluding days with 0.01 inch or more of rain and dry days following days with 0.05 inch or more rain, was 44.8 mgd; the maximum day wet weather was 90 mgd; maximum day dry weather was 49.3 mgd; the maximum wet weather rate was 115 mgd: and the maximum rate, dry weather, was 79 mgd. The data for the Richmond-Sunset and Southeast plants are not available since flows were restricted during storms.

Can We Estimate

GEORGE G. HYLAND

Maintenance Engineer,
Massachusetts Turnpike Authority,
Weston, Massachusetts

B ECAUSE the 123-mile long Massachusetts Turnpike spans the state in a general east-west direction, some section of the pike is the unwilling recipient of about every snow storm from the southwest that hits New England. In fact, there are at least four different snow zones located along the turnpike. One of the most severe, comprising Maintenance Sections 1 and 2, is located through the Berkshire Hills at the westerly end of the pike and extends for a distance of about 36 miles from the New York line easterly to the Westfield area. The next zone, Maintenance Section 3, extends through the Connecticut and Quaboag Valley area for a distance of approximately 30 miles to the Quaboag River. The next zone, which is located in a real snow belt comparable to the Berkshire section, extends for a distance of approximately 37 miles through central Massachusetts and the Worcester area and includes Maintenance Sections 4 and 5. The final area, Section 6, extends easterly for a distance of 20 miles to the terminus in Weston in Metropolitan Boston. Generally, the storms in the latter area are the mildest of those occurring along the turnpike; although very often, the easterly end of the pike experiences troublesome northeasterly storms from the Atlantic Ocean that are generally accompanied by high winds of gale force and very wet snow.

Storm Records

For the past three years, we have kept an accurate record of the time, duration, and intensity of every snow storm that has occurred any-

where on the turnpike. This information, accumulated over the years, should prove valuable not only for statistical purposes but could serve as a basis for estimating future costs or evaluating actual winter maintenance costs. However, winter maintenance is an operation that does not lend itself to the preliminary estimating of costs for budgetary purposes. The winter season is so subject to the vagaries of mother nature that it is impossible to estimate, with any degree of accuracy, the anticipated cost of winter maintenance work. We might be able to approach reasonable preliminary estimates based on past experience. To attempt to do so however, it seems to me that it is absolutely necessary to catalogue our storms and keep an accurate annual record of actual expenditures and then make a determination, annually, as to whether the winter should be classified as mild, moderate, or severe. This information coupled with average costs over a period of 3 or 4 years might serve as a basis to determine, sufficiently accurately for budgetary purposes, the anticipated costs of maintenance for the coming winter. The only thing missing is the long-range forecaster who can peer into the future and tell us into what category the anticipated winter weather will fall.

Storms are very tricky; the cost of plowing and cleaning up a 3-inch snow fall could very well exceed the cost of fighting a 9-inch storm if the 3-inch fall involved freezing rain or sleet followed by low temperatures and the 9-inch fall involved dry snow and favorable temperatures. For these reasons, comparisons can be misleading uncless all factors are considered, such as those involving: temperatures before, during, and after the storm; moisture content of the snow; wind

Table 1-Number of Turnoike Snow Storms Classified by Intensity

i dbie i	Tumber	or run	ibive a	10# 310	illia Ciu	sairieu	by inter	13117
Section	Less T	han 2"	2"	to 5"	Over 5	" to 10"	Over	10"
	59-60	60-61	59-60	60-61	59-60	60-61	59-60	60-61
1-Lee	12	9	11	8	5	5	2	3
2-Blandford	11	8	12	7	3	3	2	5
3-Chicopee	8	4	10	5	2	3	1	4
4-Warren	9	3	14	11	2	3	1	4
5-Auburn	9	8	11	9	2	2	1	4
6-Weston	9	7	6	5	0	3	1	2

Costs of Winter Maintenance?

velocity and visibility during the storm; frequency of storms; depth of snow; etc.

Seasonal Comparisons

As shown in Figure 1, the total snow fall during the past winter on the Massachusetts Turnpike exceeded that of the winter of 1959-1960. Under the circumstances, one might expect higher costs for the winter of 1960-1961 and more liberal use of salt and sand. Such was not the case however, as shown in Figure 2:

Figure 2 reveals that we used considerably less salt and sand in the past winter than in the previous one; the total overall actual cost for winter maintenance for the winter of 1960-61 was 17 percent less than the actual total cost for the 1959-1960 winter. Therefore, the total depth of snow, as of itself, cannot be used as a yardstick for estimating winter maintenance costs or for the purpose of comparing annual costs of winter maintenance.

Possibly, a more accurate estimate of salt consumption can be made on the basis of the number of storms occurring in a winter season. As shown in Table 2, Sections 1, 2, 3 and 4 used approximately the same amount of salt per storm in both winters. The information contained in Table 2 probably would prove beneficial only in comparing the average amount of salt that one might expect to use per storm in the course of the winter. It could not be extended to include estimated total expenditures for all operations included in winter maintenance work, despite the fact that the cost of salt constitutes a major item in the overall program.

Table 3—Authority-Owned Equipment Available for Winter Maintenance Operations

No.	Item		
17—Four-wheel with wing			
ies.	pions	and same	Jei Dou-

2—Heavy-duty Sicard snow blowers.
18—Mack trucks, with front plows and sander bodies.

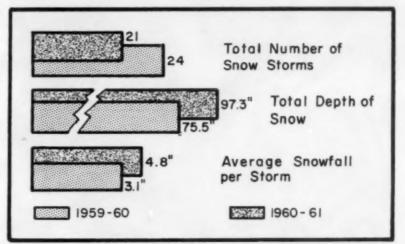
6—F600—Fords, with front plows and sander bodies.

8—Austin-Western heavy-duty graders,

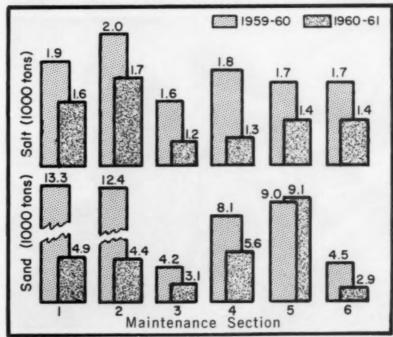
with wing plows. 15—Front-end loaders.

Table 2—Tons of Salt Used per Snow Storm

Section				
	Number of Storms	Average per Storm	Number of Storms	Average per Storm
1—Lee 2—Blandford 3—Chicopee 4—Warren 5—Auburn 6—Weston	30 28 21 26 23 16	62 tons 73 tons 75 tons 69 tons 74 tons 107 tons	25 23 16 21 23 17	62 tons 76 tons 78 tons 63 tons 62 tons 85 tons



• FIGURE 1. Average storm record for a typical Turnpike maintenance section.



• FIGURE 2. Comparison of salt and sand use during last two winter seasons.

Table 4—Comparison of Costs of Turnpike Winter Maintenance Operations

	1959-1960	1960-1961
Purchase of Salt	\$159,174	\$146,071
Purchase of Sand	58,320	37,420
Rental of Contractors Equipment	26,992	13,938
Employees' Overtime	50,890	51,870
Extra pay to maintenance men while operating equipment	4,032	3,840
Salaries of temporary employees	38,158	23,167
Total	\$337,566	\$277,306



TYPICAL heavy-duty equipment assigned to each of the six maintenance districts.



SANDER spreading salt in emergency lane to assure maximum safety for motorists.

As stated earlier, there are many factors to consider in estimating winter maintenance costs or in preparing preliminary budgetary estimates of such costs. However, an examination of the average annual expenditures over a period of 5 or 6 years coupled with analyses of the annual statistical information relating to all facets of winter maintenance operations should prove most helpful not only in estimating costs but in keeping actual costs in line from winter to winter.

Experience and Equipment

The reduction in our annual winter maintenance costs of the past winter as compared with the winter of 1959-1960 can be attributed, in part, to the fact that we had practically no storms involving freezing rain or sleet and the atmospheric conditions during and following the storms of the recent winter were more favorable than in the winter of 1959-1960. In addition, our organization in its 4th winter of fighting storms unquestionably is becoming more proficient in providing bare and safe pavements at the lowest possible expense. That we have been successful in keeping the Massachusetts Turnpike open to traffic at all times during the winter seasons since it opened in 1957 is due in no small measure to the topnotch Authority-owned equipment that we have available for plowing, salting, and sanding. All of our units are radio-equipped and furnished with sander bodies. Our 4-wheel-drive, heavy-duty trucks and graders are also equipped with wing plows, with the result that two of these units, plowing in tandem, open up 25 feet of roadway width in a single pass. Each tandem unit plows an average of twenty miles of roadway; ten eastbound and ten westbound.

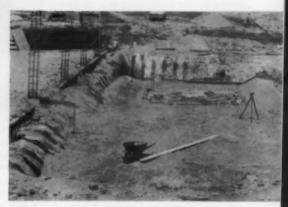
In addition to the above, we have a list of contractors who have trucks and plows available for hire when called by the section foremen.

Memphis Reorganizes Planning Commission

Three new positions have been created by reorganization of the Memphis, Tenn., Planning Commission. These include an Executive Director at \$12,000 to \$15,000; and directors for Advance and Current Planning at \$9,000 to \$12,000 each. Robert E. Palmer, 204 Hickman Bldg., Memphis, Tenn., is Committee Chairman.



● DAMAGE by both frost and soil swelling actions are minimized by soil isolation. At Left: Pool is over-excavated and lined with suitable membrane. Drainage system is placed; then 12 to 18 ins. of sand is laid over lining before the concrete floor is poured.



Where Soil and Water Should Not Mix

The "Soil-Isolation" construction method can be a convenient, practical and economical means for the control of heaving and cracking of swimming pools and reservoirs due to the destructive action of swelling soils and frost.

JEWELL R. BENSON
Consulting Bituminous Engineer,
Denver, Colorado

WIDESPREAD construction of swimming pools, both on the municipal level and in private clubs and homes throughout this country and in Canada, has directed everincreasing attention to certain problems of soil and frost conditions not previously considered serious or of major importance. These problems include soils having high volume change with varying moisture content, especially soils which are normally dry and very dense, but which, on absorption of moisture, swell with accompanying high pressures. Such soils are common in the arid to semi-arid west and southwest. In other areas, frost action assumes major importance. Frost action is difficult to predict accurately on the basis of naturally existing soil moisture, as leakage from a pool may accumulate sufficient ground moisture to cause frost heave even when no heave conditions have been observed in the area under any other circumstances. Difficulties with frost problems are frequently accentuated when the

pools are maintained in an empty condition through the winter months. Control of the destructive effects of soil swell (and sometimes shrinkage) and of frost action has become an important factor in pool design and construction.

Paradoxically, two extremes of climatic conditions cause similar effects in the heaving and cracking of concrete swimming pool structures. In one case, high ground waters plus soils of high capillarity combine to permit formation of ice lenses beginning at the contact surface and progressing downward with frost penetration, each lens contributing to the "lift" action. This results in a heave of soil and ice accompanied by forces of great magnitude, crushing and/or cracking anything in its path, including concrete floors, all the reinforcing notwithstanding. Leaks are formed which not only waste water the following season but contribute to further ice action the next winter due to a greater accumulation of water in the underlying soil.

On the other extreme is the condition prevalent in the arid to semiarid west and south-west, where soils in a desiccated condition may be compressed to high density and have a high apparent bearing capacity. However, if permitted to absorb even a modicum of moisture, these same soils may exhibit a very high volume change with exertion of great expansive forces. Some soils of this character are capable of expanding and causing raises in grade of more than six inches, accompanied by extremely high pressures and forces, equal to if not exceeding the forces of frost heaves.

The prevention of damage due to these forces has presented an interesting problem to architects and soils engineers alike. In some cases, drains have been installed below the surface to intercept aquifers feeding frost heaves. Placement of thick overlays of straw over the floors of pools in an effort to prevent frost heaving has been common practice in many areas. For control of swelling soils, recourse is frequently made to caissons and piles driven to stable soil or by restraint of swelling through the surcharge of surrounding soil. All of these methods involve complicated and expensive procedures and in some cases are of doubtful effectiveness.

As an outgrowth of work done originally by the U. S. Bureau of

Reclamation in the lining of canals in expansive soils, a new method of frost and swelling soil control has been developed. Applications of the procedure made during the past several years have given excellent results. This method has been called "soil-isolation," since the offending soil is isolated from, in one case, ice action and, in the second case, moisture. The latter is similar to the "maintenance of existing regime" practiced in Permafrost regions, except that here the purpose is to maintain the soil in a dry condition. Success of the method stems from the fact that if the moisture content of even very poor soils can be held relatively constant, many adverse volume change characteristics can be held to a minimum.

Development Work

In placing concrete linings in canals constructed in high volume change soils which were normally dry, the Bureau of Reclamation first experimented with sprayed - type asphalt membranes. These were placed over the excavated soil and the concrete lining was placed directly over the membrane. The results, while not perfect, were very encouraging and several installations of this type of construction have been made by the Bureau since the original work was performed between Lindsay and Dexter, California, on the Friant-Kern Canal. However, a major weakness in this method was breakage of the asphalt film due to movement of the concrete. Breakage and failure of the asphalt membrane was accelerated by an unusual phenomena caused by decreased subgrade friction of the asphalt membrane underseal. Though only about onefourth the number of contraction cracks appeared in the lining, the cracks which did appear were four times larger than normal. Such unusually large movements stretched the asphalt beyond the breaking point and the seal was lost.

An apparent answer to membrane breakage problems was to obtain a tougher sealing material and to separate the membrane from the concrete by a layer of permeable granular material. Watertightness is retained by the sealing material while the granular cushion course minimizes troublesome differential movements and permits control of frost heave, partly by thermal insulation and partly by control of water intake into the soil.

The culmination of the various ideas and experiments led to the use of prefabricated asphalt and



● FORMS can be braced against the membrane lining. Short 2x4's were cemented on with hot mop asphalt and bracing struts nailed to the pieces.

asphalt-plastic linings which are laid directly over the soil and covered with a substantial cushion course of permeable sand or sand-gravel. A drainage system is incorporated in the cushion course. Incidental to the control of soil reactions, a number of other benefits have been demonstrated since the water-tight membrane lining keeps the work out of the mud, reducing delays after rain or snow. Also the lining serves to keep reinforcing clean.

Materials

Two types of lining material are available for this purpose. Both possess the necessary ruggedness to withstand the construction activities inherent in use of the lining and both are easily placed, watertight and immune to rotting or deterioration over very long periods of time under usual service condition. The original prefabricated material consisted of a heavy ½-in. thick mat type of lining, made of an asphalt-felt-mineral core coated with weather-proofed asphalt-saturated felts. This material, when carefully placed, has given very good results.

Recently, a new lining material consisting of a heavy poly-vinyl-chloride plastic sheet, armored with layers of asphalt and asphalt-saturated felts, has made its appearance. This has the advantages of lighter weight and more convenient placement and jointing, while still retaining the high degree of ruggedness necessary to withstand both construction operations and service conditions. This material is current-

ly being produced by W. R. Meadows, Inc., Elgin, Illinois, under the trade name "Meadowmat."

Construction Method

The normal construction procedure for use of the soil isolation system is, first, the over-excavation of the pool or reservoir area to permit a minimum of 12 inches of granular backfill over the bottom and at the sides of the structure. All slopes in this excavated area are trimmed and berms and inverts rounded to permit convenient placement of the prefabricated membrane. If clods, rocks or other rough surfaces are present, these are rolled with a flatfaced steel roller (a lawn roller frequently suffices). Provisions for placement of tile drain over the membrane is preferably made by construction of one or more shallow trenches in the bottom portion of the excavation, sloping the trenches from high points or far ends of the excavation to a central closed pipe drain line. The drain trenches are rounded and sloped to permit contouring of the membrane lining and nesting of the tile. Discharge is to an open ditch some distance away from the pool or into a prepared (and frequently asphalt-mat-lined) sump where any leakage from the pool or reservoir may be easily observed and the water filtered and reclaimed if desired.

In certain unusual cases, intercepting drains must be placed below the soil-isolation lining to take care of ground water elevations exceeding the elevation of the bottom of the excavation. Drainage of such water is important where frost actions must be controlled and where the depth of frost penetration may be expected to reach such excessive ground waters.

The prefabricated asphalt mat or asphalt-plastic membrane is supplied in sheet form, usually 4 feet wide and in lengths of from 12 feet to 15 feet. The asphalt mat lining normally is 1/2-inch thick while the thickness of the asphalt-plastic lining is 1/8-inch. Asphalt mat linings are usually laid in a butt joint pattern using gusset strips to cover the joints while the asphalt-plastic lining is usually laid in a lap pattern, lapping longitudinal joints 3 inches and transverse joints 6 inches. To obtain maximum stability on side slopes, the sheets are placed longitudinally on the slopes with the upper ends tucked under the soil and covered with several inches to a foot of soil to give adequate anchorage. Extension of the lining to cover sidewalk areas is made by

lapping additional material over the berm areas and extending the sheets to the outer edges of the walks. The pattern for placement of the lining in the bottom portion is optional except that on slopes it is usually preferable to place sheets parallel with the slope.

Several methods are used for cementing joints in the lining material. Most convenient, in the absence of heating equipment, is the use of cold-applied asphalt mastic. This material, of paste consistency, may be applied by hand or trowel, usually to both surfaces to be joined, and the joints or gussets then carefully pressed into place. Lighter grades may be forced through a pipe and nozzle by proper pressure equipment for faster application. Any excess mastic exuding from the joint is used as a painting material, additionally sealing the joint. Where asphalt kettles are available and can be easily handled, hot-mop asphalt cement, mopped liberally to both faces of the joint and then quickly pressed together, provides a fast and economical method of jointing. However, the hot-mop method is subject to poor results if the operations are not performed quickly and if the entire joint area is not immediately and completely pressed into place. If the hot-mop asphalt is allowed to chill even slightly, a false joint is created which, while apparently strong mechanically, has little watertightness and will leak excessively on contact with water. In recent months, a special cutback, high viscosity asphalt cement has been developed for use with the 1/8-in. asphalt-plastic lining. This gives promise of much faster, easier and consistently leakproof jointing than either the hot-mop or cold-applied asphalt mastic. The cutback cannot be used with the heavy mat lining due to the stiffness of the lining material.

Pipes and drains are easily brought through the lining and cemented in place without danger of leakage of seep water. For entry of pipes and drains, the lining is slit and opened and the pipe or drain inserted. Prior to fitting and closing the lining, a liberal quantity of asphalt mastic is placed around the pipe and under the lining, after which the lining is replaced. A collar of lining, usually a square extending out 12 inches from the pipe, is then slit and cut to fit snugly around the pipe. With the slit in the opposite direction of the first lining slit, cold mastic is used copiously over the seating area and the collar slipped into place and seated. A heavy asphalt mastic point is then placed around the exterior of the pipe-lining junction. Where very large pipes are involved it is customary to cast a concrete collar around the pipe, the face of the collar flush with the subgrade surface and extending out at least six inches to provide a firm and tight seat for the lining. A heavy coat of mastic is placed over the collar seat before placing the lining and the seal effected as previously noted.

On completion of the membrane or mat lining, open-joint drain tile is installed. A small piece of asphalt saturated felt is used above the joints to prevent infiltration of sand into the tile. With the tile in place, the bottom of the pool area is backfilled with granular, permeable material, sand or sand-gravel being preferable. This material should be at least 12 inches in thickness and should be compacted by vibratory or pneumatic tampers to effect consolidation and stability. After the backfill is levelled, forms are placed for pouring the floor. The forms may be braced against steep sections of the membrane lining itself, using a short piece of 2 x 4 seated

against the membrane with the brace nailed to the seating piece. In some cases braces may be extended to the top of the excavation and fastened to stakes in a conventional manner. With the floor poured, forms for wall sections may be completed and poured, with a portion of the bracing load now carried on the poured floor area.

On completion of pouring and form stripping, the membrane lining should be carefully inspected and all holes and punctures should be sealed with an over-lay of additional lining material before backfilling. Back-fill with the granular material, compaction, and pouring of adjacent walk areas may then be undertaken

The results of more than three years of use of this method under swimming pools, in areas subject to heaving, swelling soils, has demonstrated excellent control over these destructive forces. A vivid contrast was provided by the appearance of one main pool, protected by this soil-isolation method, in comparison with a shallow wading pool some fifty feet distant from the main pool but not protected by isolation. At this date, almost four years after construction, no cracking or disturbance of concrete has occurred in the main pool while the wading pool has extensive cracking both in the pool and in adjacent walkways, with more than 10 percent of the total area either completely replaced or severely patched. Other walks and curbs have shown large movements of heave or subsidence, with much concrete deterioration from these causes.

Soil isolation by means of adequate, rugged and long-lasting asphalt or asphalt-plastic membranes should be given serious consideration wherever high-volume change soils exist or where frost action is indicated. 000



• POOL shown here under construction is protected with half-inch thick membrane placed with gussetted butt joints.



• THE SAME pool, after four seasons of use, has no leaks although an adjacent unprotected wading pool cracked badly.

New Inlet Design for Culverts

MARK F. LOOSCHEN

Preliminary Bridge Design Division Iowa Highway Commission Ames, Iowa

N THE PAST several years, the use of culverts with specially designed inlets has been on the increase in the State of Iowa. Since 1953, from 75 to 100 culverts of the flared-inlet type have been designed and constructed on the several road systems of the state. The use of special inlet design has spread from the primary and interstate road systems to the county road systems.

Most of these culverts drain areas of medium size, namely from 150 to 300 acres. However, flared inlets have been used to drain areas as large as several square miles, and, occasionally as small as 60 to 80 acres.

Sizes of flared inlet culverts will vary from 20 x 10 inlets flared to 10 x 10 barrels down to 4 x 4 inlets flared to 3 x 3 barrels. Inlet sections have also been designed which taper rectangular shape openings down to smaller arch shape culvert barrels. For example a 12 x 12 rectangular section has been tapered to a 9 x 11 arch section. Also existing structures which have proven inadequate have been extended with flared extensions to increase their capacity.

The purpose of special inlet design is primarily to save money. For example, the barrel of a 10 x 10 culvert, under a 13 foot fill, costs approximately \$120 per linear foot. The barrel of an 8 x 8 culvert under the same fill would cost about \$81 per linear foot. If such a culvert was constructed under an interstate section (50 foot median) it would be at least 180 feet long. Current prices in Iowa would indicate a difference in cost of about \$7,000 between the two barrels. This amount more than pays for the extra cost in design and construction of the flared inlet.

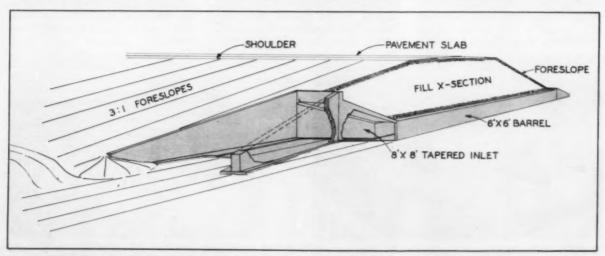
The amount of money saved depends on the amount of concrete saved, which in turn depends on the size and length of the culvert. It follows that a culvert with a 4 x 4 inlet tapered to a 3 x 3 barrel would have to be much longer than a culvert with larger dimensions to save the same amount of concrete.

The primary advantages of flared inlet design are reduced cost and possibly more efficient hydraulic performance. Some of the disadvantages are that they are more difficult to design, they are harder to build and, should it ever become necessary, they are more costly to extend

The idea of special inlet design for culverts is not a new one. The Iowa design is based largely on information contained in Bureau of Public Roads Circular Number 2 entitled "Hydraulic Information". This circular is dated September, 1951. Many of these culverts have been built in various parts of the country. In Iowa the use of the flared inlet has progressed to the point where nearly every culvert on the primary and Interstate systems, which will qualify, is designed with a flared inlet.

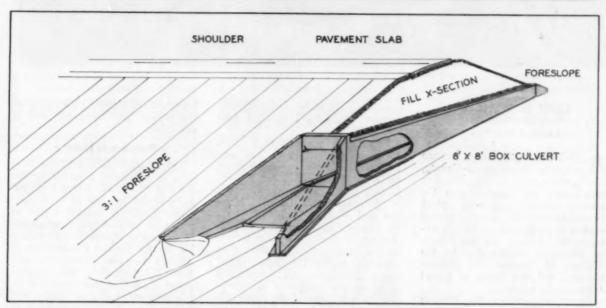
The Iowa design is a compromise between rigid hydraulic design, good construction practice and common sense. In the design of a flared inlet, the culvert inlet is made large enough to keep the depth of water at the entrance within allowable limits. The culvert barrel is designed to flow nearly full when carrying design discharge. The Iowa designs almost universally have flume and stilling basin type outlets. And nearly all of these outlets are the standard Iowa Highway department flume.

In order to qualify for enlarged inlet design a proposed culvert site must meet three basic requirements. The first requirement is that the proposed culvert must be long enough so that the savings which can be realized will be considerably greater than the added cost of design and construction. The second requirement is that the drainage area be large enough to warrant consideration. Usually a drainage area of at least 60 acres of rolling topography is required. The third, and most limiting requirement is that sufficient fall must exist to enable a design of this type to operate. It is much preferred to have this fall



BOX CULVERT design employs a flared inlet which reduces an 8 x 8 section to a 6 x 6 barrel to cut construction cost.

Saves Highway Dollars for Iowa



• PREVIOUSLY used type of culvert was a square structure having an 8-ft. opening at each end and same size barrel.

exist naturally rather than be created artificially by raising the inlet flow line. The required fall must be enough to allow for the initial drop in the inlet tapered section, the required gradient on the culvert barrel and some additional fall for the installation of the flume and stilling basin. Usually a culvert site at which the stream gradient approaches 2 per cent will qualify for flared inlet design. The purpose of keeping the outlet flow line above stream bed is for insurance against filling and assurance of entrance control.

Steps in Design

There are four basic steps in the design of an enlarged inlet culvert. The first step is to choose a design discharge. The second step is to determine the allowable depth of water at the entrance to the culvert. The third step is to choose an entrance size which will not cause the depth of water to exceed the allowable limit. The last step is to choose a barrel size.

The design discharge can be chosen by any of several methods. In Iowa a chart is used to obtain discharges for drainage areas up to several thousand acres. This chart was prepared by highway department engineers to fit the topography, rainfall and runoff characteristics of the state.

The allowable depth of water at the entrance of a culvert will depend on the topography and use of the land. Timbered or pasture areas can be temporarily ponded to greater depths than cultivated or residential areas. Steep or hilly topography is more adaptable to ponding than flat or gently rolling terrain. In nearly all cases, the allowable depth is kept at the top of opening of the culvert or just slightly higher.

The size of the entrance in most cases is the same as in a conventional culvert design. For example, if an 8 x 8 culvert is required for a particular site and this site meets the requirements for tapered inlet design, then an 8 x 8 entrance is merely tapered down to the chosen smaller barrel size.

The drop in the entrance section must not be less than the difference in total head at the ends of the entrance section.

The length of the tapered section is a minimum of three times the amount of drop.

It is possible to use a smaller barrel size because a culvert when set on a steep grade will not flow full even though the depth of water at the entrance is greater than the height of the barrel. Normal depth for an 8 x 8 barrel on a two per cent slope carrying 500 cubic feet per second is approximately 3 feet. A 6 x 6 barrel will carry this same discharge at a normal depth of about 5½ feet on a slope of one percent. The Iowa design requires that the barrel of a flared inlet culvert be at least 50 percent of the entrance area. One reason for this limitation is to allow for the passage of small drift. The grade of the barrel section cannot be set to exact requirements because most flared inlet designs are for higher fills and the barrels are cambered. For this reason an allowance is made so that the culvert will operate satisfactorily if settlement is greater or less than predicted.

The barrel size of a flared inlet culvert then, depends on the size of the entrance and the available fall—in any case the barrel chosen is one which will flow nearly full when carrying design discharge.

The preceding remarks relate to the design of enlarged inlet culverts constructed in Iowa and, as earlier mentioned, their design is a compromise between rigid hydraulic control, good construction practice and common sense.

Niagara County Solves Its Water Problem

LEON H. WENDEL Consulting Engineer, Lockport, New York

A 13-YEAR OLD dream became a reality for Niagara County, N. Y., when early in 1961, the first water from the County's new 12-million gallon treatment plant flowed through the 65-mile supply system of the County to provide water to the 12 towns and the Village of Barker in Niagara County, the Village of Medina in Orleans County, and the Town of Grand Island in Eric County.

Since 1948, when the Niagara County Board of Supervisors first ordered an engineering study of the needs and problems of providing a common supply of good quality water for all the communities throughout the County, much time, money and effort has been expended on both the State and Local levels. The original report, to the Niagara County Board of Supervisors, first noted the desirability of transcending County boundaries and thus pointed out the need for studies at the State level. Based on this report, the State Legislature, in 1949 set up the Temporary Commission on Northwestern New York Water Supply, from which the Northwestern New York Water Authority was created during the Legislative session of 1950.

This Authority was given the task of planning, developing and administering a water supply program, on a wholesale basis, for a five-County area including the Counties. of Niagara, Orleans, Genesee, Monroe and Wayne. While ultimately unsuccessful in its purpose, this Authority did perform a great service to the Niagara Frontier during its nine-year tenure. The Authority had many problems: An educational program was necessary to relieve the fears of some of the communities, while the general theory of provincialism had to be overcome. More than once legal barriers had to be circumvented and legislation was needed, at times, before further progress could be made.

Finally, by 1958, plans and specifications were complete for the Authority's first project. Since the Authority was not given taxing powers, only revenues from the sale of water were available to meet the expenses of the project and the inability to obtain this type of financing proved to be the final handicap which the Authority could not remove. This work, however, provided the springboard which quickly

launched the County of Niagara on the project now completed and in operation.

Program Is Unique

The Niagara County Water District is a unique program in the State of New York in that its prime purpose for existing is to supply, under pressure, treated water to points of take-off on a wholesale basis, making it economically possible for the various communities to develop their own distribution systems. The heretofore impossible expense of reaching long distances for adequate water of good quality and having to construct costly treatment and pumping facilities has been eliminated. Many areas within the County already have availed themselves of this supply and others are moving rapidly toward the creation of districts which for years were considered financially impossible. Some 300 miles of new distribution system have been constructed since water was made available in the County mains. Even the City of Lockport, which for many years had shown no interest in any participation, is now augmenting its existing facilities through the construction of an interconnection with the County system.

The entire project, costing approximately \$10,000,000, was under contract by May, 1959, less than one year after the County undertook the project. The pipelines, reservoirs, service center and booster station were completed during the summer of 1960 and, through interconnections to the City of Niagara Falls system, immediate use was made of the piping system to relieve the critically water-short areas throughout Niagara County and in the Village of Medina in Orleans County. The intake works and treatment plant were scheduled for completion by May, 1961, but, to the credit of all concerned, these facilities were placed in operation almost two months ahead of schedule.



NIAGARA COUNTY'S new 12 MGD treatment plant, designed for economy and
efficiency, houses the filter area, control building and the high service pump station.

The system has, as its source of water, the West Branch of the Niagara River, the so-called "Emerald Channel." The intake crib is fully submerged and of such a design that it is expected to be self cleaning and free of the ice problems sometimes found troublesome in the Niagara River. Twin intake pipes 60 inches in diameter connect this crib to the raw water pump well, located some 500 feet away in Buckhorn State Park on Grand Island. Reinforced concrete pipe was used for these intake tubes. The crib and the outer sections were laid in very firm clay with piling and pile bents as additional precautionary support. Nearer shore, a mishap occurred during construction which required the removal of some sections of pipe and disturbed the trench bottom so that stabilizing slag and concrete cradles were added to the inshore sections. The raw water pumping station on Grand Island has been equipped with automatically controlled moving screens and has four 75 hp, 6.4 mgd Johnston mixed flow pumps, controlled automatically from the treatment plant by means of a BIF supervisory control and alarm system employing telephone lines as the connecting link, Discharge pressure from this station is recorded on a local, direct reading pressure recorder and is controlled through the use of a surge relief

valve which recirculates sufficient water to maintain a predetermined maximum pressure even during periods of little or no flow.

The raw water pumping station discharges the water, under pressure, through approximately four miles of 42-inch main to the treatment plant in the Town of Wheatfield. Roughly 3,700 feet of this pipeline was laid as subaqueous pipe in a trench cut in the bottom of the East Branch of the Niagara River. (See Public Works for April, 1961.) The pipe used for this purpose was 42 - inch reinforced non - cylinder, non-prestressed concrete low pressure water pipe. Steel joint rings were used throughout and all subaqueous pipe was lugged.

The river crossing proved to be particularly difficult due, in part, to the heavy river current; the depth of water, in some sections 25 to 30 feet; and the general toughness of the bottom materials at this point in the river. On two occasions, once in 1959 and again in 1960, sections of pipe were damaged and had to be removed, which delayed the completion of this section of pipe. W. L. Hailey & Company, Inc., the prime contractor, in 1960 sublet this river work to L. A. Wells Company. Shortly after the latter began work, rock was encountered. The equipment at hand, however, was able to remove this rock without recourse

to blasting, and this, while costly, did not cause delay in the progress of this very difficult portion of the work. Because of the late start coupled with a very heavy ice flow condition, the installation of the last 2,700 feet of this pipe was slow and tricky. At times, near the shore of Grand Island, very strong crosscurrents further hampered the work of the laying crew.

In addition to the 42-inch pipe, a 16-inch steel water main was placed in the same trench. This pipe will be the means of supplying filtered water back to Grand Island starting

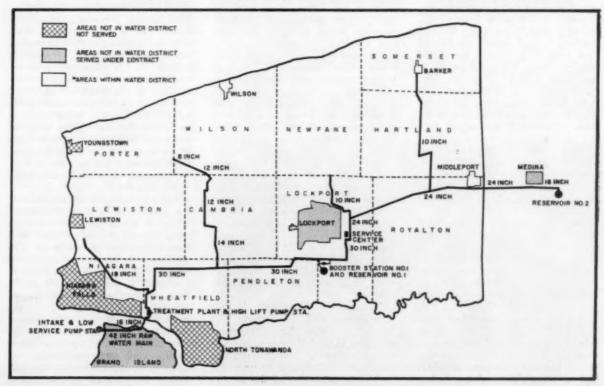
some time this year.

Treatment and Pumping

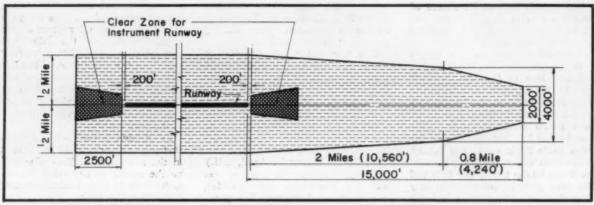
The 12-million gallon filtration and treatment plant was designed for economy but, at the same time, with full consideration for maximum flexibility and operational efficiency. The plant, through its auto-central control and alarm system, can be and is operated by only two men per shift in addition, during the daylight hours, to the Plant Superintendent and Chemist, Dr. Warren K. Eglof.

The treatment process employs a centrifugal type rapid mixing tank coupled to three Pfaudler-Permutit horizontal type-rapid updraft precipitators, and six rapid sand filters using Wheeler bottoms and

(Continued on page 192)



MAP of Niagara County shows how the new water supply system reaches all twelve townships plus areas outside of District.



LIGHT shading indicates area recommended for nonresidential development and exclusion of places of public assembly.

Airport Vicinity Land Use Studies ... An Urgent Need

LAWRENCE A. WAITE,

Captain, U.S. Navy (Retired)
Aviation and Airport Operations
Consultant
Bedell & Nelson Engineers, Inc.
New Orleans, La.

NE VITAL ASPECT of community land use planning today involves integrating the jet airport into the community structure. An airport is no longer an isolated entity as it was in the early days of aviation. It must now be considered as a unit in a densely populated area, whatever the development of that area may be presently. The introduction of jet-powered aircraft in the larger urban areas has intensified the community reaction to the noise generated in the airport area and emphasizes the necessity for a detailed study of compatible land use. This study is essential to the protection of investments in public airports and to the protection of persons and property in the airport environment.

The immediate need for such studies was accentuated by a recent action of the Federal Housing Authority. The FHA decreed that no loans would be granted for housing in "noisy areas near jet airports" because it considers such housing a bad financial risk. This area was tentatively defined as being three miles long and one mile wide measuring from the ends of the dominant runways. It should be stressed that at best this is a very general definition as certain determining factors such as terrain, existing structures,

flight patterns and location of runways will vary with each airport. Consequently, individual acoustical studies of each airport should be made so that proper zoning of adjacent areas may be accomplished.

The FHA decision certainly stressed the fact that there must be as little conflict as possible between the airport and its surrounding area, lest both suffer. For example, military jet bases have reported that friction with local residents over the highly irritating jet noise has resulted in numerous complaints and even lawsuits and eventually caused severe curtailment of base operations and prevented full utilization of these multi-million dollar facilities. Obviously a vital community asset such as a jet terminal cannot risk this sort of interference. Another factor to consider is the value of land around the airport. It is agreed that certain types of industrial and administrative activities can function efficiently in an area where a residential zone would lose a large part of its value due to noise annoyance. It is elementary, then, that, although adjacent land has to be carefully and rigidly zoned by professionals, the land subject to the higher levels of jet noise can certainly be profitably utilized.

An airport land use study is vital to both new and old airports. The benefits to a new airport are obvious. The acoustical survey and resulting zoning plan precludes future land use conflict and insures the maximum utilization of the airport and adjacent area. It will enable

each property owner to derive the maximum value from the use of the land since the purposes for which the land may be used will be definitely known by the owner. Consequently, a better relationship between the community, the airport officials and those responsible for enforcing the zoning regulations is bound to result.

The benefits to an older airport in a developed area are less obvious but are equally important. In view of the present FHA ruling (and inevitable future federal regulations), an acoustical study of an old airport is an absolute necessity. Only by making such a study can the "noisy area" be accurately measured. Certain factors previously mentioned make this area vary with each airport. Consequently individual studies must be made. This study will enable all concerned property owners to know where they stand relative to the FHA ruling. Blind acceptance of the dimensions given by the FHA might bring property owners under the ruling when an acoustical survey would show them to be well out of the noisy area. Only an individual acoustical survey of each airport can accurately define this area.

The solution of these problems is the purpose of an Airport land use study. It is no job for amateurs. Only impartial professionals with long experience in designing airports and in laying out residential and industrial sites are properly qualified to make such a study. Now, when urban expansion threatens to engulf and strangle many development of a comprehensive airports, it is imperative that the land use plan based upon acoustical studies and implemented by the adoption of appropriate zoning ordinances be initiated at the earliest possible time.

HAROLD S. ROBERTS

Safety Director, Pennsylvania Turnpike Commission, Harrisburg, Pennsylvania

HE NATION'S FIRST superhighway, the Pennsylvania Turnpike, in 1960 had its best safety record in its 20-year history. This year we anticipate it will be even better. Last year we had 47 fatal accidents in which 66 persons lost their lives for a mark of 3.0 deaths per 100 million miles traveled.

The 1960 mark compares favorably with that of 1959 when 62 fatal accidents took the lives of 78 persons or 3.7 deaths per 100 million miles. The improved 1960 record was achieved despite an approximate 5 percent traffic increase and a devastating winter that spread 178 inches of snow over much of the turnpike.

In recent years the Pennsylvania Turnpike has shown a marked improvement in accident numbers. This achievement can be attributed to many causes, including a wellmaintained turnpike, aggressive safety education, inspection of vehicles at interchanges and sound driving habits by travelers.

Beginning September 1 of this year, Pennsylvania came into line with other states in the use of radar for detecting speeders. Seven years ago the Turnpike Commission purchased five radar sets. The equipment was used for gathering vehicle speed data so as to keep all department heads concerned with turnpike safety abreast of speed problem as it related to accident causation. The radar survey meters were instrumental in helping the Commission change maximum speeds on the System from time to time as well as zoning speeds at critical areas such as major structures, tunnels and certain junctions.

The radar equipment was never used as an enforcement tool because it was not covered by Pennsylvania laws. However, in the 1961 legislative session, the House and Senate passed and the Governor signed into law, a bill permitting the use of radar for detecting speed of motor vehicles. The statute provides for penalties consistent with other legal methods of speed enforcement.

The biggest factor in highway safety is the man behind the wheel. We can design and build modern road networks but drivers must keep pace with these developments in improved driving habits before safety is an accomplished fact. To meet this problem, the Pennsylvania

Aggressive Safety Program Earns a Record for the Pennsylvania Turnpike

Turnpike has established a program of strict enforcement, good road maintenance, public education, improved safety facilities, on-the-road safety signs at work sites and safety markings on all moving road equip-

Each category takes in a vast area, but each is most necessary for improving safety. For instance, the state police on the turnpike, paid by the Commission out of toll revenues, have increased their complement to 185 officers and men. This year the enforcement bill will come to more than \$1,750,000, but the additional 15 men on the turnpike will give us better enforcement and should help cut accidents and deaths.

Maintenance Important

Road maintenance probably is one of the most significant factors behind our safety program. Some of the major developments in this up-todate program are:

1) Resurfacing the original turnpike between Carlisle and Irwin.

2) Stabilizing shoulders.

3) Adding drainage on original turnpike.

4) Larger and more readable signs, regulatory and directional.

5) Mudjacking sagging pavement.

6) Erection of medial guard rail.

7) Modifying interchanges to facilitate traffic.

8) Adding light in the tunnels. 9) Wider and more lasting traffic lines.

10) Excellent snow removal and

roadway maintenance.

During 1960 the Commission contracted with a private weather forecasting service. The accuracy of the predictions of the arrival of storms, speed of winds, total accumulation and location of the storms was excellent throughout the winter. In fact, the weather service, which does its forecasting from New Bedford, Mass. more than 600 miles away, hit 33 of the 34 storms on the nose. Staying ahead of the storms has been a factor in the success of the turnpike's snow removal program and has reflected on the turnpike's safety record. Although the winter of 1960-61 was one of the worst in our history the safety record was one of the best of any

The turnpike's public education program is a big one. One of our latest efforts has been in the field of spot announcements over the piped-in music systems at service areas. Safety announcements not exceeding 30 seconds in length are



RADAR enforcement of speed limits spots a violator on the Pennsylvania Turnpike. Speed limit in the work zone is 35 miles per hour, yet the meter reads "50".

Table 1—Accident Report for the Pennsylvania Turnpike System by Calendar Years

October 1, 1940 to December 31, 1960

Year	Fatal Accidents	Fatalities	Injury Accident	Injuries	Total Accidents	Vehicles Using	Miles Driven	Fatality Rate (1)	Injury Rate (2
1940	5	5	47	101	138	640,000	53,200,000	9.4	189.8
1941	20	26	198	402	529	2,630,000	242,200,000	10.7	166.0
1942	12	14	100	180	298	1,520,000	128,500,000	10.9	140.1
1943	7	7	53	106	212	1,000,000	87,300,000	8.0	121.4
1944	12	14	77	153	232	1,140,000	96,900,000	14.4	157.9
1945	12	16	86	158	238	1,600,000	142,800,000	11.2	110.6
1946	14	24	124	233	331	2,600,000	244,600,000	9.8	95.3
1947	13	17	139	269	399	3,100,000	292,318,261	5.8	92.0
1948	21	25	195	402	535	3,563,845	343,345,471	7.3	117.1
1949	28	39	227	456	609	4,051,442	390,952,582	10.0	116.6
1950	42	59	338	624	949	4,774,389	475,939,605	12.4	131.1
1951	47	66	502	975	1,409	7,777,508	774,215,981	8.5	125.9
1952	62	83	623	1,177	1,832	11,372,117	1,141,782,280	7.3	103.1
1953	69	91	520	1,090	1,639	12,023,363	1,206,239,339	7.5	90.4
1954	39	51	462	899	1,323	13,061,556	1,217,462,962	4.2	73.8
1955	65	90	571	1,090	1,652	17,614,133	1,415,942,389	6.4	77.0
1956	56	74	584	1,133	1,651	21,924,713	1,619,402,908	4.6	70.0
1957	48	62	563	1,043	1,930	25,910,623	1,862,204,644	3.3	56.0
1958	57	80	516	1,038	1,809	27,304,792	1,927,112,079	4.1	53.9
1959	62	78	580	1,041	1,889	30,228,780	2,080,174,998	3.7	50.0
1960	47	66	564	1,063	2,028	31,698,876	2,155,358,591	3.0	49.3

⁽¹⁾ Fatalities per 100 million vehicle miles.

beamed to those in the restaurant and encourage motorists to stay alert, not to drive when tired, to check tires, gas, oil, lights, etc.

Accident Study

The Commission this year spearheaded a program to determine why accidents were occurring with the same pattern. The Pennsylvania Medical Society was asked to cooperate and a committee of doctors and staff members of the Commission sat down to evaluate the problem. They found that turnpike accidents fall into these categories: Rear end, cross-over, fixed objects, medial guard rail and non-collision. The study revealed that over the years the percentage of the rearend accidents and fixed-object mishaps was basically the same. These categories account, for about 75 percent of the turnpike accidents.

This meant one thing to the seasoned safety man as well as to the medical people who were being indoctrinated with a relatively new subject. It meant that people were driving beyond their physical capacities. Some drivers were apparently driving while under the in-

fluence of medicine that affect their reflexes. In general, though, safety people believed that drivers failed to recognize the difference between traveling on a highspeed superhighway and routine in-town or county highway driving where the roadway and speeds are greatly different.

Another recent feature of the safety program on the turnpike was the mounting of oversized speedometers on the roofs of safety station wagons that are stationed every 100 miles along the highway. These oversized speedometers, known as "speedminders," are accurately calibrated each month and serve as constant reminders to passing drivers.

Work Area Safety

Still plaguing the Commission is how to control speeds of vehicles in work areas. Although these areas are well signed with caution and reduced-speed signs and state police patrols are assigned to the work areas, there is still a great disrespect of reduced speed limits.

During three weeks of the month of June 1960 three turnpike maintenance men were killed by trucks

whose drivers failed to keep their vehicles under control. Although in two of the three cases the areas were signed with large brightlypainted caution markers, drivers still barreled down on the men. One of the drivers claimed bad brakes but when police teams and mechanics checked they found the brakes and the lining to be in good condition. In the other case, a man on a paint crew was killed when the driver claimed he was "forced" into the turnpike truck. Police never found the other driver who was said to have caused the accident. The third maintenance man was killed when his vehicle was struck from the rear by a truck traveling in the same direction.

Two years ago the Commission striped black and white zebra markings on the tailgates of all turnpike equipment which already was painted bright orange. In addition, each unit has revolving emergency lights on the cab and flashing amber lights on the rear for snow removal and cinder operations. In spite of this marking program, records show that eight snow plows were struck while removing snow last year.

⁽²⁾ Injuries per 100 million vehicle miles.

An additional 91 miles of medial guard rail were erected last year in an effort to reduce cross-over accidents. The program was initiated with some reservations because many engineers did not believe the barrier would be a salvation." Commission records show that many vehicles over the years have gone across the 10-ft. wide medial strip without being involved in accidents. In fact, state police and maintenance people learned that over a year's period more than 800 vehicles had crossed the center strip without being involved in an accident. This year there have been two fatal accidents as a result of hitting the medial barrier. Three persons have lost their lives in these mishaps. The Commission will continue to evaluate the data being compiled and will guide itself accordingly.

This year we are striving for another record. For the first six months there were 37 fewer accidents than a year ago, despite the fact that more than 10 million additional miles have been driven on the pike and in one day more than 142,500 vehicles used the road over a 24-hour period.

About 25 percent of the accidents on the Turnpike involve the age group between 17 and 25 years. What makes this problem greater than it first appears is the fact that this age group does not constitute a significantly large percentage of our drivers. We can't honestly pinpoint what percentage the 17-25 age group represents, but we believe it is about 10 percent since little commuter traffic is represented on the Turnpike and commercial vehicles must be operated by drivers over 21.

In Pennsylvania several pieces of legislation are aimed at the youthful driver. One of these proposed laws would prevent teenagers from driving between the hours of midnight and 5:00 a.m. unless accompanied by a responsible adult.

The Turnpike this year will handle more than 32 million vehicles. Every one of these vehicles will be an accident potential. Inspections at interchanges by the officer collector will prevent about 5,000 vehicles from using the pike because of bad tires and lights and other mechanical faults this year.

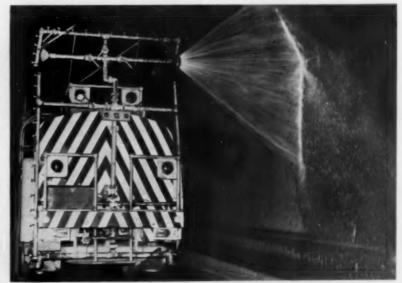
For those cars that do use the Turnpike we will continue to do everything within the power of the Commissioners, staff members and the men in the field, to make each year a better and safer year in the history of the nation's first turnpike.



SNOW on the Pennsylvania Turnpike is a signal for immediate action. Starting to fight snow early, and with plenty of modern equipment, is the secret of success.



TURNPIKE SAFETY patrol vehicles have oversized speedometers as constant reminders to motorists. The "speedminder" units are stationed about 100 miles apart.



 PROTECTION of maintenance crews and passing motorists is enhanced by black and white xebra striping at the rear of all equipment, such as this tunnel washer.

TV CAMERA INSPECTS 1000 FEET OF SEWER A DAY

R. G. KRAMER, City Engineer, Waukegan, Illinois

THE USE of a television camera for sewer line inspections is proving a valuable time-saver in our sewer maintenance program. In addition, the complete panorama of sewer interiors given by this camera is enabling us to pinpoint trouble spots with a much higher degree of accuracy than we obtained in our former method of inspection.

Like many other municipalities, our sewer problem is both immediate and long range because of an aging system. Many of our sewers are about 40 years old. Two breaks in the past two years have indicated that costly restoration measures will be an ever-increasing problem for us in the future. In addition we need to conduct remedial work on existing sewers to enable them to handle increasing loads thrust on them by population growth. Both the storm and sanitary sewer systems are involved.

To deal with these problems, in the fall of 1960 we retained the consultants, H. B. Bleck Engineering Co. of Waukegan, Ill., to make a complete study of our sewer and water systems over an area of 29 square miles. The Bleck engineers used aerial photography and watershed design records to determine capacities of existing sewer lines for accommodating additional sanitary flow from expanded and proposed

residential areas. The sudden overloads of flash flooding and infiltration and the flow characteristics of existing lines are also being studied.

It was felt that, as far as the sanitary sewers were concerned, the consulting firm should determine: 1) If anything were wrong with existing trunk sewers, branch sewers or laterals, such as broken pipe, partial blockages by accumulation of roots; 2) if the sewers are adequate for the existing loads and for ultimate sanitary loads from the fully built up annexed areas within the sanitary drainage area which drains to Lake Michigan; and 3) what the design should be of any trunk or branch sanitary reinforcing sewers, and also of sanitary trunk and branch sewer extensions, particularly sizes and locations to provide for development for the ultimate Lake Michigan drainage area.

The first phase of this study, as far as the City was concerned, was to investigate the trouble areas and get relief for people having basement flooding. Due to lack of equipment and experience our own sewer maintenance crew was not capable of handling the job. It was suggested, therefore, that the consulting engineers investigate these areas and take such remedial action as power rodding to bring immediate relief.

The Engineers recommended that, in addition to power rodding, TV inspection be tried to determine the condition of these sewers where trouble existed after the rodding had been accomplished. The actual power rodding and TV inspection was conducted by National Power Rodding Corp., of Chicago.

The immediate problems that troubled us were in two areas: A 30-in. line in our Northwest System and an 18-in. line in the West Central System. Two cave-ins had occurred in these lines, one of which necessitated repair of a 12-ft. long section at a cost of \$1,000.

Cleaning and Inspection

The program we finally devised follows these procedures: First, the rodding and bucketing of sewers by our own crews, plus supplemental power rodding when conditions cannot be handled by our own men; and second, inspections with the TV camera.

Power rodding and cleaning is accomplished with the aid of two bucket machines, stationed at manholes from 300 to 600 ft. apart. The bucket on the machine cable is drawn through the sewer by motors developing up to 50 hp. Movement of the bucket in the line is controlled by hand signalling between winch operators at each manhole.



CREW setting TV camera, in stainless steel case, in manhole to start inspection.

Cleaning of the sewers is completed by running a porcupine brush through the section. It takes a crew of three men five days to rod and clean 2.300 ft. of 18-in. main.

clean 2,300 ft. of 18-in. main.

A typical TV inspection was conducted on a 294-ft. section of an 18-in. sewer in the West Central System. The mobile TV trailer was stationed at one manhole, while a power winch trailer was set up at the other manhole. The TV camera, encased in a stainless steel tube and riding on looped steel skids, was lowered into the sewer. A tag line, drawn by the winch, pulled the camera along the invert of the sewer at the rate of one foot every five seconds.

As the camera passed through the sewer, observers in the mobile trailer were presented with the entire 360 degree view of the sewer interior on the TV screen. When root penetrations or incipient or major cracks appeared, the inspector stopped or reversed the camera's movement by intercom communication with the winch operator. The exact location of the trouble was recorded on a distance meter in the winch trailer. Also, a Polaroid camera aimed at the TV screen took photographs of trouble spots for future analysis.

Sewer inspections with the TV camera have given us the advan-

tages of speed and accuracy. With it, we can make 1,000 ft. of sewer inspection per day. Moreover, the monitor gives us a clear picture not obtained with a lamping inspection, since it is difficult to see joint offsets by lamping. The camera indicates, too, where tree roots start to penetrate sewer walls, enabling us to run a root cutter through the line to clear it and forestall the progress of a major crack; or to indicate where a tree should be cut down to ward off future trouble.

The camera has the added advantage of illustrating the problems before several engineers simultaneously so that their findings can be correlated on the spot, and corrective measures agreed upon.

Advantages of TV Inspection

Although initial TV inspection costs are higher, for certain situations the use of the camera is well worth the cost. For instance, there is a time saving; a saving in engineering costs through quicker, better information; and savings to property owners through better maintenance, based upon intelligent appraisal and exact knowledge of the sewer's condition. Summing up, here are the advantages I find in the use of the TV camera in sewer inspections.

1) It is a safe method.

It can be used on small sized sewers where it is impossible to get a man through.

3) It is fast.

 It is possible to get a permanent log of a sewer's condition for future reference.

5) An engineer can make a "calculated risk" estimate of the life of the sewer, determining where trouble might occur and the extent of that trouble.

6) The engineer gets an exact picture of the inside of a sewer in place and the kind of problems encountered, or which might be encountered, in any sewer. It is of educational value to the engineer and will help him realize the importance of design and construction as well as inspection procedures and their importance.

7) It will help with decisions by the engineer as to what must be rebuilt or repaired, or what can be left for the future. It will help him estimate the life that is left in a

8) The engineer can locate roots, bad joints and cracks; and from this information, he can determine whether trees should be cut down at certain locations; he will see, for instance, where roots are entering the sewer from a wye branch and where an individual property owner is causing trouble.



● MOBILE television studio as set up on the street to inspect interior of an 18-inch sewer line in Waukegan, III.

Street Lighting Progress Recorded in Lake Worth



● STUDY in contrast: The old-type incandescent light is shown, before its removal, alongside a new mercury vapor installation near the City Hall. First project covered the business area but plans are now underway to extend the new lighting program to residential areas.

GROWING PAINS have become the rule, rather than exception in Lake Worth, Fiorida. During the past 10 years the permanent population has risen from 8,000 to 20,758 recorded by the U.S. Census Bureau in 1960. Commensurate with the expansion were the need for good water, better sewage facilities, additional power for the municipal power plant and an adequate street lighting program.

All these things cost money and all were on the priority list of city officials for many years. In the past three years a \$1,600,000 water treatment plant; \$2,550,000 sewage disposal plant and \$2,100,000 steam power plant have been completed.

The street lighting program got "off the ground" late in 1959 after the annual budget for 1960 was approved by the City Commission and funds were allocated for the project. City Manager Tom G. Smith and Line Distribution Superintendent H. B. Bearrow canvassed the city to determine the best starting point. The business section was selected and work started in March, 1960.

A seven block area on the two main streets (as well as three blocks north and south of the main intersection on U.S. Highway No. 1) were divided into three sections. Sixty-seven new Revere 400-watt mercury vapor luminares were mounted on six-foot upsweep brackets attached at 29-foot mounting height on erdalith-treated poles.

Three 25 KVA transformers, with multiple-circuit 240-volt aerial construction, were used to avoid overloading any one circuit. Each run was 2500-ft. long and the source was at approximately the center of each run. The poles were staggered at 100-ft. spacing with a street width of 60 ft. The lights are operated on Fisher-Pierce photoelectric cells with Westinghouse oil circuit breakers. The new system replaces the old underground 6.6 series circuit that supplied the obsolete 12-ft. standards with incandescent lighting of 2500 lumens.

With the initial project finished, phase two got started in February, 1961, when lights were extended from the business district to the east and west approaches to the city on the main streets. A total of 179 new mercury vapor units were installed. The third phase, completed in March, 1961, consisted of the erection of 160 lights along U.S. 1 from the north to south city limits.

In addition to the installations noted above, 14 mercury vapor lights were erected at two sections of the city beach parking areas. All poles are painted aluminum enhancing the well-lighted effect. Approximate total cost was \$56,000. Plans are now in discussion for extending the program to residential areas of the city.

Response has been overwhelmingly favorable from businessmen and residents alike. Police Chief Henry Hall also pointed out that better lighting has reduced vandalism and petty crimes within the business area by 75 percent.

Secondary Road Improvement by Stage Construction

H. Gordon Blundon, Jr., Assistant Secondary Roads Engineer, Virginia Department of Highways presented this paper at the 1961 ARBA meeting in Atlantic City, New Jersey.

DRIOR TO 1932, all of the county roads in Virginia were maintained and improved by the individual counties from "Road Fund Levies" on property by each county. As a result of this, we had, in effect, 100 county highway departments and one state highway department. As road building became more complex, it became evident that some method would have to be devised whereby there would be available to all sections of the State the engineering and road-building capabilities necessary for a unified system of highways. Through the foresight and leadership of our senior Senator Harry F. Byrd, Sr., in 1932 the Legislature passed what has been known since that time as the "Byrd Road Act." This Act, in substance, gave each county in Virginia the privilege of relieving itself of the road maintenance and improvement problems confronting it and turning them over to the central Virginia Department of Highways. Of our 100 counties, 96 are availing themselves of this privilege, two have become cities and two operate their own highway departments.

The Virginia Department of Highways in 1932 was geared to a 9,000mile Primary System and some aid to the counties in the form of State aid. So, on July 1, 1932, when we added to this system 35,900 miles of Secondary roads, we really took on a problem. To give you some idea of the immensity of this problem, our Secondary System then consisted of 2,000 miles of hardsurfaced roads, 8,000 miles of roads that had a little soil and gravel as a wearing surface, and 25,000 miles of plain mud roads. After the task of arranging for the organization necessary to cope with such a problem came the question, "Should we take the few dollars available and build, to very high standards, roads that are designed for anticipated traffic volumes of many years hence, thereby building just a few miles and giving service to just a few; or should we take our few dollars and

spend them over the entire system in such a manner as to give the greatest possible service to the greatest number of people?" The decision was to give the greatest amount of service to the greatest number of people and, while it has resulted in many miles of presently inadequate roads, the people have, nevertheless, had the benefit of some type of service throughout the state for the entire period.

In 1932, only \$6,362,000 was available for all types of secondary work. Even at the deflated prices of those years, this was a trifling sum. Over the years our system has grown and so have our funds. By 1940-41 our hardsurfaced mileage had increased to 6,900, our mileage surfaced with stone and soil had increased to 18,-400 and we had decreased our unsurfaced mileage to 12,230. By this time, we had gone to the point where we had the sum of \$8,680,000 for maintenance and improvement of this system. From these figures, it can easily be determined what was occurring. We were taking the present roads, widening them occasionally, adding a little base material and surface-treating them. For our other roads, we were just adding base material in an attempt to make them "travable."

During the war years road-building almost came to a standstill. Nothing was done but meager main-

tenance. However, immediately after the war, the school consolidation idea hit Virginia. It, therefore, became necessary that many miles of road that were "travable" only during good weather be made "travable" during all types of weather. Beginning in 1946 through 1947 and into 1948, we went into one of the greatest stabilization programs that we had ever encountered. Millions of tons of stabilization material were hauled and spread on our roads. We just followed the present location, because it was financially impossible to make any improvements to our grades and/or alignments. It was at this time that we adopted the slogan, "not a school bus day lost due to mud." About \$10 million was expended in stabilization materials. While many miles will have to be rebuilt and much of the stabilization has now gone down the drain, we, nevertheless, have had a miraculous record as to school bus days lost on account of mud. Under Virginia law at the present time, we must maintain our system in such manner that no child will have to walk more than one mile along a public road in order to get to a school bus.

By 1950-51, we had increased our hardsurfaced mileage to 13,000, our stabilized surfaces to 22,730 miles and our unsurfaced mileage to 3,828. Our funds had also increased to \$21



● TYPICAL of Virginia secondary improvement projects is this bridge and approach job in Amelia County; it is an 18' by 8" aggregate base with prime and double seal.

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	Mountainous		1	30	20		56°	10%	15%			1		18'	16:18	4'	4'			24	20	H-20	H-I5	15'	H-15	80'	40'

GEOMETRIC design standards for secondary roads in Virginia based on average daily traffic volume and type of terrain.

million. At about this period, it became apparent that we were approaching the point where our system was "travable" enough and "out of the mud" enough to begin thinking of long-term planning and construction based on long-range traffic estimates. It took some years for this thought to fully develop and it wasn't until the Spring of 1958 that such a plan was put into effect. At that time we were faced with the problem of arranging our Secondary System to meet the new demands of heavy truck hauling that had been recently put upon it by the passage of a weight control law which placed our top limit at 56,800 lbs., or an 18,000-lb. axle load. So, on June 20, 1958, a set of standards was adopted for a pavement design for new secondary road construction. The basis for this design was a 10,000-lb. wheel load on a subgrade having a minimum CBR of 10. The design runs from 6 in. of commercial aggregate material to 8 in. of local material for light traffic of from 0-200 vpd, on up to the higher type bases of six inches of

lime or cement-treated base and six to eight inches of black base and plant mix surface.

Improved Geometrics

While we were improving our base design, we were also improving geometric standards generally. We had, previous to this, been adhering to the minimum standards as set forth by the American Association of State Highway Officials. In general, this ran from 12 feet of surface for traffic counts under 100 to 20 feet of surface for traffic of 1000 vpd. We adhered to minimums, therefore, we had very few roads that were being built with 20-foot surfaces on the Secondary System. Our first move was to the "Desire Standard" of AASHO and then, after careful consideration, a new set of standards was set up for our Secondary System, with a 16-ft. minimum pavement width for any foreseeable traffic less than 100 vpd; and 18 to 20-ft, pavement for any foreseeable traffic of from 100 to 1000 vpd; 20 to 22-ft. pavement from 1000 to 4000 vpd and a divided highway

for anything over 4000 vpd. We further set up a type of urban design, which varies anywhere from 36 ft. of pavement with 2.5-ft. curbs and gutters to a 58-ft. pavement with 2.5-ft. curbs and gutters, including a flush median or at times a wide median

Our system in Virginia varies greatly as to traffic density. The 1960 traffic counts indicate a system of 38,698 miles having a vpd count of less than 400; 3,066 miles having from 400 to 4000, and 60 miles over 4000 vpd. We are, therefore, charged with the responsibility of maintaining and improving roads that carry from zero to ten vpd; we also are charged with the responsibility of maintaining and building roads with capacities of 12,000 to 20,000 vpd. In fact, we are doing something at present that a few years ago would have been unheard of. We are planning limited access Secondary roads and hope to have one under contract this year.

It has been for some years now, our goal to have a highway system that has a bituminous surface or its

equivalent on all roads carrying more than 50 vpd, to have an allweather gravel or soil surface on all roads carrying from 10 to 50 vpd, and to have a light surface on all roads carrying zero to 10 vpd. In other words, we are not only interested in that 12,000 to 20,000 vpd road, but we are also interested in that widow who lives at the end of a dead-end road and comes out once a week.

Stage Construction

Virginia is primarily a rural state. We have great expanses of area with a small population per square mile and many miles of low traffic roads. It is on these roads that we are taxed to our utmost to do something with the few dollars available. We make every effort to use, wherever possible, local materials for base construction so as to keep costs to a minimum. Where these are not available, commercial aggregate material is used. On any roads that we are rebuilding which carry traffic up to 400 vpd, we attempt the construction in a stage process; that is, construct the road, apply the base and let it weather from one to two winters before applying a hard surface. This confronts us with the dust problem, the "corduroying" and the loss of base materials that go along with an untreated surface.

People were quite pleased at knowing that they were getting an improved road in front of their homes; however, if we finished the first stage and left them with the same type of surface they had before, with all the dust and the other inconveniences, they complained loudly. We have set up a policy of using a surface application of calcium chloride in the first stage and continued maintenance as a calcium-treated road to alleviate the dust problem and to hold down our base material so that at the end of one or two winters we have not lost enough base to require adding additional material before surface treating. This chloride is initially applied at the rate of a 134 lbs. per sq. yd.

As is the case with any local material or aggregate base, it is necessary that it either be premixed at a central plant or that it be roadmixed. Upon the completion of the placing of the premix material or the road-mixing and before compaction, we apply one pound of chloride. After the road is compacted and shaped, we apply three-quarters of a pound of calcium chloride so that the final surface has a full and even application spread throughout. We have been getting a very fine recep-

tion to this. While the roads in front of people's homes are not hardsurfaced immediately, they do not have the dust problem; our maintenance operations are reduced and we are not losing our base material. We have found that this gives us a better road and that we are able to go in and correct any weakness or base deficiencies prior to the time of surface-treating. This has resulted in a surface, when treated, that is unblemished by scars and patches for quite a few years.

Light Surface Treatment

We also use a tremendous amount of light surfaces on our Secondary System. These light surfaces formerly consisted of a prime and seal; however, we have found that we can gain much by applying the second seal at the time of surfacing. These treatments, on roads carrying less than 600 vpd, usually consist of a rapid-curing asphalt applied at the rate of about 0.3 gal. per sq. yd. with 25 lbs. of No. 68 stone, as a prime; followed with approximately 0.25 gal. of an asphalt having a 200-300 penetration again covered with No. 68 stone; and a third application or final seal of 0.25 gal. of 200-300 penetration asphalt, and a final covering of No. 78 stone. This gives us somewhat of a modified or light penetration. We have found that this type of surface, applied two to three years after construction, usually lasts five years without any further application of asphalt.

We even use this type of construction on some of our higher traffic roads where there is an abundance of local material available. In the initial stages of construction, we apply a light surface to the base and let it go for several years before applying a high-type surface of a plant-mixed material.

Recently we constructed about six miles of this type of road carrying from two to three thousand vpd. For the first winter, we had very little break-up on our light surface; however, it did show some signs of distress. These distress spots were corrected, and the following winter other distresses were corrected. During the second summer, we applied a two-inch blanket of plantmix material. We now have an excellent road that is performing well and showing no signs of distress even though traffic is picking up in

density and in weight.

In another phase of our program, we have applied calcium chloride in front of houses for distances of two and three hundred feet on each side. This has been met with a great deal of enthusiasm. For a number of years we did this at no cost to adjacent property owners. Because of financial difficulties, we now apply it only where the residents purchase the chloride and we furnish the labor for application. Even this is meeting with quite some success and we are applying quite a bit of material for this purpose. It is hoped that in the near future our financial



CALCIUM chloride is used as a dust preventive and also as a means of conserving base material. After one or two years of service, such roads are hard surfaced.

situation will reach the point where we will again be able to give this service at no additional cost to our

Our State has always operated on a "pay-as-you-go" plan, and any deficit created during one year must be repaid the following year before any other work is planned. On work performed by our own forces we find ourselves improving many miles of road in multi-stage processes, especially those roads that fall just below the group being bituminous surface treated. In many cases the normal schedule of hardsurfacing is as much as five to seven years off when we start the improvements. This means that maintenance is high and base loss considerable. In an attempt to give better service we have investigated calcium treatment of these roads until they meet the traffic usage criteria for hardsurface.

From the \$6,362,000 for our Secondary System in 1932-33, we have gone to better than 42 millions of dollars in 1960-61; and it appears that our 1961-62 allocations will be approximately 43 millions of dollars. We have gone from a highway system in 1932 of 35,900 miles of road with 2,000 having a hard surface and 25,000 being mud roads, to a system in 1960 of 41,769 miles of Secondary roads with 20,351 having a hard surface-and only 1,787 miles having no surface. We have gone from a plan of doing something to the road that was in place to a system whereby we design for traffic fifteen to twenty years hence. We have gone from bases that would only carry traffic during periods of extremely light weather to bases which we hope will carry traffic during any type of weather. We have gone from alignments that were set up for horses and buggies and maximum speeds of 25 to 30 miles an hour, to the standard design for speeds up to 70 miles per hour. We have gone from a maintenance program of conditioning roads twice a year to a program of continuous conditioning. We have gone from a program of allowing the sun to melt the snow on the Secondary System to a program of attempting to get every mile of road open as soon as possible. In Virginia, our Secondary Road Program is looking forward to more and better road improvements. We are almost "out of the mud" and with each mile of improvement performed, we are building to a standard which will accommodate traffic for many years.

Survey Shows

Street Sweeping is a Big Job for Cities

ROBERT DYMENT

Technical Journalist

A SURVEY of various cities throughout the United States shows that all have problems in regard to sweeping streets but a combination of modern equipment and up-to-date engineering methods

is doing much in keeping America's streets clean.

One of the most important factors in regard to successful street cleaning seems to be in getting cars away from the curb on sweeping days. Harold R. Dean, Superintendent of Public Works for the City of Poughkeepsie, N. Y., said, "Cleaning operation is handled by two large power sweepers—1 Wayne and 1 Elgin. In addition we have a small sweeper which cleans the city parking lots and cruises around the central business area picking up what many of the storekeepers push into the gutter after sweeping out their stores in the morning. This is done six days per week. A sweeping schedule is followed so that the entire residential area is power swept at least once every two weeks. If especially dirty, then oftener. The business area is swept and flushed six nights a week. Special sweeping assignments are made when necessary.

"We have very little trouble in sweeping the business area of the city since sweeping is carried out between 1 a.m. and 7 a.m. The real problem is on many of the residential streets where there are no garages or driveways off the street and cars stand on the street day and night. Sweeping is, therefore, non-existent until the Police are asked to clear the street long enough to sweep. This is a most unsatisfactory arrangement. The Traffic Commission is now considering alternate side of the street parking in the residential areas of heavy car concentration. This will help tremendously. This department has no legal authority to move cars, for which we are thankful.

"The large sweepers have specified dump areas. These dumps are picked up by front end loaders and trucks daily. A street flusher

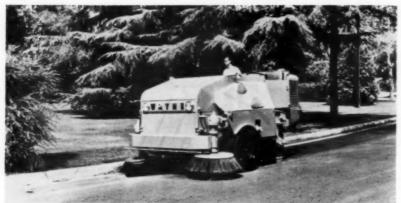
follows the sweeper on every street."

Street cleaning in the City of Miami, Florida, is a function of the Department of Public Service through its Streets, Bridges and Sewers Division. The Street Cleaning Section is comprised of 39 men and operates on a yearly budget of approximately \$177,000. The personnel set up is as follows: 1 supervisor, 3 foremen, 6 sweeper operators, 1 truck driver, 1 maintenance repairman and 27 laborers.

Miami has seven mechanical sweepers, operating six on day and night shifts and keeping one machine as a spare. They have the following types of mechanical sweepers: 1 Wayne, 1955, 3 cy; 3 Wayne, 1956, 4 cy; 2 Elgin, 1958, 3 cy and 1 Wayne, 1959, 3 cy. In addition to the mechanical sweepers, Miami uses 22 men with hand carts.

The mechanical sweepers sweep approximately 150 curb miles per twenty four hours, and the hand crews sweep approximately 85 curb miles per day. The mechanical sweepers are used only on the streets with full pavement, curb and gutter and concentrate primarily on the downtown central business district and the various business centers in other parts of the city. Although Miami is not at present flushing the streets, they are in the process of purchasing an automatic, self-propelled street flusher, and intend to use it in the central business district.

To eliminate the interference of parked cars with the sweeping operation, the Public Service Department has requested the Metropolitan Dade County Traffic and Transportation Department to prohibit parking in the central business district during the hours of 2:00 a.m. to 6:00 a.m.



Courtesy Wayne Manufacturing Company

STREET sweeper with four cu. yd. hopper travels extra miles before dumping.

Like most large cities, the trend in St. Louis, Missouri, is from hand sweeping to mechanical sweeping. This has become necessary due to the increasing cost of labor. Flushing the streets with motor flushers is giving way to mechanical brooms. Each time the street is resurfaced the curb line is lower, restricting the amount of pressure that can be used by a flusher. This reduces their usefulness, according to an official of the St. Louis Department of Streets.

Restricted parking for a period of time for street cleaning is an accepted method in many large cities. St. Louis has been experimenting with this system for the last six months, and will expand this operation. At present they are using cardboard signs which cost 10¢ each.

St. Louis has 1,100 miles of streets with a street cleaning budget of approximately \$1,000,000 per year or \$1.33 per capita (population 750,000) for street cleaning. The street department also works on snow and ice control. The above figures do not include maintenance of equipment.

The street department has 250 employees and approximately 90 percent of the budget is spent for labor. Following is a list of the St. Louis equipment: 15 motor sweepers, 1 vacuum sweeper, 13 flushers, 3 overthe-cab loaders, 41 dump trucks, 5 salt-spreading trucks with plows, 20 attachable salt spreaders and 500 litter boxes or baskets throughout the city.

The City of Saint Paul, Minn., with an area of fifty-two square miles, has about nine hundred miles of streets of which three hundred are paved, one hundred and twenty-five are unimproved and the balance are oiled. J.M. Cotter, Supt. of Sanitation, Dept. of Public Works said, "Our street cleaning is accomplished with twelve street sweepers, eleven of which are Elgins with detachable

Dempster hoppers. We also use seven street flushers and an average of one hundred street laborers and twenty trucks. Approximately thirty-five men and five trucks are used in the loop area, the balance being distributed throughout the city. During the spring clean-up of the sand and winter debris, the hand crews precede the power sweepers in removing the heavy material from the gutter assisted by three frontend loaders. After the initial clean up, the sweepers are assigned to definite routes.

"The loop area is cleaned nightly with four sweepers and one Dempster truck. Other commercial streets and outlying paved streets are cleaned semi-weekly and bi-weekly depending upon the need. The residential paved streets are cleaned at three to five week intervals. The oiled streets are not generally cleaned after the application of oil except for heavily traveled thoroughfares and then only as necessary with a power sweeper.

"The loop area is restricted to parking between the hours of 2:00 a.m. to 7:00 a.m. The commercial streets in the outlying area generally have alternate parking between the hours of 2:00 a.m. and 7:00 a.m. On the residential streets we use a method of posting. All residential sweeping is done during the daytime. The loop and commercial area are completed during the night hours."

The City of Tulsa, Oklahoma, is divided into seven districts, for the purpose of street cleaning. The street cleaning equipment consists of: 7 five-ton, 2,000-gallon flushers; 11 two-ton dump trucks; 3 four-yard mechanical sweepers; and 3 leaf-loaders. Personnel to operate equipment are as follows: 7 flusher drivers, 7 truck drivers, 3 sweeper drivers and 13 laborers or helpers. From the above equipment and personnel, each

one of the seven districts is allowed 1 flusher and driver, 1 dump truck and driver and 2 helpers.

Two eight hour shifts, one during the day and one during the night, use the same amount of personnel and the same equipment. The day shift cleans the outlying and residential areas, consisting of approximately 550 miles of paved streets and alleys (it takes about 6 to 9 weeks to clean one district completely).

The night shift cleans the main thoroughfares twice each week and the downtown districts (which is approximately one hundred miles of paved streets and alleys) six nights a week. They also have approximately one hundred 30-gallon trash containers in the downtown district on corners and in shopping centers that are emptied six nights a week.

Both crews are given instructions at the beginning of the working day where they are to work that day. Two laborers sweep the debris into piles along the curb line in the street with HiWay Hand Brooms and load on the dump truck with panning shovels. When debris is too heavy with dirt and mud to use the brooms, they use the panning shovels to pile and pick up the debris. They also use panning shovels to cut and load grass hanging over the top of the curb. Each truck in each district gathers approximately three truck loads of debris in each eight hour shift, making a total of approximately 21 truck loads of debris per shift.

Floyd Anderson, Tulsa Street Maintenance Superintendent said, "After the streets are free from debris, they are flushed clean with the flushers. There is always some debris that is not collected with the panning shovels that the flushers wash to the catch basins. These are then cleaned off by hand. The flushers average about 45 blocks or 90 curb blocks each day.

"The three mechanical sweepers are rotated from one district to another as needed. When this is done, the flushers will average twice as many blocks, depending on whether we have a place to dump the sweeper. If we do not have a place to dump, the sweepings are dumped on the street and picked up with hand shovels.

"Since the City of Tulsa does not have a law against parking on the street day or night, we have to clean around parked cars which create quite a problem.

"The crew on the leaf machine consists of two truck drivers, one feeder and a curb man. The reason

for two drivers is that when one truck is loaded, one driver takes it to the dump and the other driver loads the other truck. By doing this, the leaf machine is kept at work.

"The leaves are packed in the truck and will not dump by raising the bed, so potato forks are used to loosen the leaves. When the leaf season is in full swing, which is approximately from October 15 to January 15, each machine picks up on the average of five loads per day. We have special beds arranged so that they will hold about five times as many leaves as the ordinary dump bed. They will average about 100 curb blocks per day.

"When season is dry, we can clean and pick up more leaves and clean more curb blocks in less time than during wet season. Each area is covered from four to five times per season where needed. The best way to pick up leaves is for the curb man to go ahead of the machine and sweep the leaves about a foot away from the curb to keep the suction spout from scraping the curb. By sweeping the leaves away from the curb, you also loosen the ones that are stuck to the pavement and this makes it easier to feed in the

machine."

The City of Spokane, Washington, uses nine street sweepers. During clement weather they sweep the downtown area every night and streets in the vicinity of outlying shopping zones and shopping centers approximately once a week. The residential areas are on a schedule once every two weeks.

Spokane has no satisfactory solution for moving cars away from the curb on sweeping days; however, they are investigating the matter and probably will pass an ordinance permitting parking on the oddnumbered side of the street on odd dates and on the even side of the street on even dates. By proper scheduling, they will be able to clean their curb lines better.

Garden Refuse

J.C. Jennings, Assistant City Engineer, City of Sacramento, Califor-nia, said, "The city's problem is complicated by the fact that not only is the normal leaf and other refuse cleaned from the streets, but also garden refuse which is placed in the gutters by the householder. This refuse is restricted to garden cuttings and clippings and must not contain any trash, soil, bricks, plaster, wood, etc. Prunings and brush must be cut to lengths which one man can easily load with a fork.



Courtesy Mobil Sweeper Div

• ONE OF Rochester, N. Y.'s, street sweepers at work in a residential section.



MANY cities operate sweepers at night to avoid the problem of parked cars.

"All of our equipment is open dump truck type, no packers being used. The light routes are loaded manually; the heavier ones and those during leaf season are loaded with mechanical loaders. Street cleaning crews work two shifts, Monday through Friday. Pickups are made on schedule once a week. in accordance with designated regulations. The collected refuse is disposed of in a sanitary land fill along with the city's garbage.

"Streets are all swept periodically by a fleet of mechanical sweepers.

The downtown area is swept each night, while arterials and highways are swept once a week. The residential area is swept once each two weeks."

Street sweeping and cleaning continues to be a big job for public works officials. Most superintendents of streets agree that there are problems yet to be solved, but modern equipment and up-to-date engineering methods are doing much to simplify the variety of operations connected with keeping America's streets clean.

THE CONVERSION OF SEA WATER: A Discussion of Method and Costs

FRED A. LOEBEL
President,
Aqua-Chem, Inc.,
Waukesha, Wisconsin

WCH has been written and spoken about the problems and techniques of converting sea water to fresh water. At Aqua-Chem we employ evaporating and electrodialysis for conversion. At the same time, we continually seek more economical methods regardless of what the process might be. To date, however, we have found no way to supplant evaporation for sea water, which we classify as follows:

1) Submerged Tube: There are

1) Submerged Tube: There are some plants using this old and widely used design in operation on sea water which are among the most successful installations from a mechanical standpoint. We believe, however, that some basic limitations to this system have been indicated in sufficiently definite form to suggest strongly that the present trend to other types will continue.

2) Long Tube Vertical: The Office of Saline Water has done research and pilot plant work on the longtube vertical plant and has selected it as the first of five demonstration plants covered by the Anderson Bill, recently approved by Congress. There are no installations on record of this type of plant for sea water, although it has been used for salt brines. Apparently, the success of this type of plant is contingent on a feed treatment system which will prevent scale formation and will provide corrosion control so that steel tubes can be used.

3) Vapor Compression; Where the raw water can be treated readily by softening, this is perhaps the most favorable method known today. It is used for sea water evaporating applications which fall within these approximate limits: (a) Relatively small plants, up to 200,000 gallons per day; (b) where fuel is difficult to procure or relatively expensive; (c) where good maintenance facilities are available.

This type is highly efficient and compact and as such may be suited for many military uses. It has limitations which seem to preclude it from consideration for large scale

sea water plants now, but future improvements will probably make it more favorable, if not one of the best ultimately. The low energy requirement is attractive where primary energy must be used as compared with waste heat.

Although the first cost would be somewhat higher, it is interesting to contemplate that with enough heating surface and an efficient compressor, a machine using this process could be built today which would come closer to the theoretical 2.8 kwh per thousand gallons of pure water from sea water than any other available process.

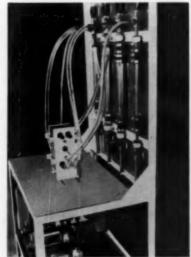
4) Multi-stage Flash: In recent years our efforts in research, design and manufacturing have been mainly concentrated on the low temperature multi-stage flash evaporator for marine and land-based applications. Aqua-Chem continues to offer vapor compression and submerged tube types, but the flash evaporator is more widely applicable for the following reasons: (a) It operates substantially without scale; (b) it is simple to operate and maintain with few controls and moving parts; (c) it can use a relatively low level heat source; and (d) first cost is favor-

It follows that this type is a good choice when waste heat can be used, as, for example, from diesel engines. When combined with a power plant using steam from condensing-extraction turbines, the cost of water is about \$1.00 per thousand gallons.

This technique is rapidly gaining acceptance in the marine field. For example, it was used for the 70,000 gpd distillation units on the USS Enterprise, the country's first nuclear powered aircraft carrier. The four units comprise the largest distilling plant—280,000 gallons daily—ever placed on a sea going vessel.

5) Electrodialysis: In the electrodialysis process, brackish water is fed between two ion permeable membranes and an electric current is passed through the cell. The membranes are so designed that one is selective to positively charged ions and the other to negatively charged ions. One membrane passes negative ions and the other positive ions with the result that the water in the stream between the membranes becomes purified while the water on the opposite sides of the membranes becomes concentrated with salinity.

Our company recently completed an agreement with the developer of this process, T.N.O., a Netherlands research organization. Under the agreement, Aqua-Chem has exclusive manufacturing rights in North America and has access to the full store of the developer's accumulated





● LABORATORY model of a demineralizer unit using the electrodialysis method in which electrically charged membranes separate impurities from brackish water.

data and experience. This process will not be used for sea water conversion at this time. Rather, it is expected to find municipal and commercial applications in such states as South Dakota, North Dakota, Arizona, New Mexico, Texas, Oklahoma, Nevada, Colorado and Kansas where brackish waters are a problem.

6) Other Processes: Other processes such as freezing and utilization of solar energy as a heat source are now under study but their commercial application has not yet been proved.

Estimated Costs

The combination of multi-effect or multi-stage flash plants with electric power plants has gained favor in recent years. A number of plants of this type have been installed and others are now being considered. This type of arrangement results in one of the most economical ways of converting sea water.

The amount of water that can be obtained from a steam power plant by using extraction steam from the turbine for heating the evaporator will vary somewhat, depending on many factors. A figure of 71/2 gallons per kilowatt hour, however, has proved to be factual in a number of actual projects we have investigated. Based on an electrical consumption of 8 kilowatt hours per person per day (which is reasonable for an industrial area), the water production would be 60 gallons per person per day. Based on this average, we may look at what the \$1.00 figure would mean for domestic consumption where water is in short

In the United States, the consumption per capita for all uses is about 1,000 gallons per person per day. For municipal and rural use, it is about 100 gallons per person per day. With some attention to conservation, a 60-gallon figure is quite adequate, but does not include uses such as lawn sprinkling. The monthly water bill at \$1.20 per thousand gallons, including distribution, would be \$2.15 per person, which does not seem unreasonable. In such a community, it follows that agriculture could not exist unless water could be obtained in some other way as, by reuse, reclamation or from sources not suitable for human use.

For a number of current projects, costs for a "combined" plant have been figured by considering the water as a by-product of electric power. This seems logical and has been acceptable to a number of power companies, since electric power is able to stand on its own feet, whereas water is generally not.

When a water plant is added to a power plant, the turbines takes more steam, and the boilers must be larger. The customary way to figure cost of water is, therefore, to charge the water plant for all additional costs which the power plant incurs, as compared to operating alone with conventional generating and condensing equipment.

Cost figures for a million gallon per day net output sea water plant, combined with about a 5500 kilowatt electrical load, are estimated to be as follows:

For a multi-stage flash plant heated by steam at atmospheric pressure from a 6,000 kwh extraction-condensing turbine, steam to turbine at 600 psig and 825°F; fuel at 8.5 cents per gallon; steel construction with non-ferrous tubes and tube sheets, \$1,534,900. Working capital required would be \$61,-000 and the operating costs per day would be: for fuel and power \$550; for amortization \$300; and for other

items \$165. The cost per thousand gallons would be \$1.02. Utilizing latest improvements, the investment could be reduced to about \$1 million and the overall cost to about 90 cents per thousand gallons.

Investment includes transportation, insurance, erection, water storage, interest on capital during construction, engineering, contingencies, and site. Annual costs include 20-year (4 percent) amortization, 4 percent interest on investment and working capital, all maintenance, labor, supplies, fuel, power, taxes and insurance.

One of the most significant developments in this field is the Southern California Edison Company, Los Angeles, Calif., pilot plant to convert sea water to fresh water at its Mandalay steam station near Oxnard, Calif. The demonstration unit, operated in conjunction with existing steam generating facilities, is the first of its kind in the country. Purpose of the conversion plant is to serve as a pilot unit to demonstrate the size and other factors for extrapolation to capacities of five to 10 million gallons a day.

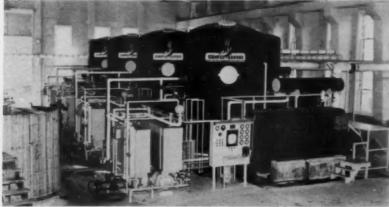
Current Progress

Cost progress has been good with regard to plants for domestic, marine and some industrial uses. During the past decade, the installed sea water distilling plant capacity throughout the world has grown substantially. Our own company has produced over 4,000 units of all sizes and shapes with a total fresh water capacity of over 16 million gallons a day.

In the conversion of sea water for agricultural use, it is evident that we still have some way to go. With regard to reduction of costs in the future, target costs of 50 cents and lower per thousand gallons have been set. This will be increasingly difficult for any process which must be confined in a plant.

For costs lower than this, it would seem that the process must ultimately be one where some "free" natural energy and facilities can be largely employed. Cloud seeding would be one such process. Another might be in the biological field, the separation being accomplished by plant or animal life.

Even the space age has a water problem. In his adventures into space, man must either take with him a huge amount of water—highly improbable because of the weight factor—or must find a method of reclaiming a small, existing supply of water through repeat distillation.



• AIR FORCE base in Bermuda has four Cleaver-Brooks units, totalling 8400 gph.

Cutting **Operating** Costs Through a Systematic Maintenance Plan



H. H. DONALDSON

Marketing Technical Service Division Gulf Research & Development Company Hamarville, Pennsylvania

S URVEYS have shown that many operators of truck and car fleets do not keep adequate records of vehicle maintenance and do not know what their vehicle operating costs really are. Significant savings can be made when a preventive maintenance program is installed to control these costs.

It has been proven time and again that scheduled preventive maintenance and adequate records are profitable investments. The dividends are measured in terms of reduced fuel and oil consumption, fewer delays, repairs, and road failures. The dividends are kept flowing by making frequent inspections and preventive repairs. Although preventive maintenance programs vary with the types of vehicles and the services they perform, they all have the same goal: longer vehicle dependability at lowest per-mile cost.

Establishing a satisfactory program is a fairly simple procedure. In fact, when the proper records are kept, a pattern of good maintenance practices will quickly establish itself. Generally speaking, the four basic considerations are: 1) Selection of the proper fuels and lubricants: 2) frequency of lubrication; 3) frequency of adjustment or tune-up; and 4) inspection pro-

A fifth point in any good program -one that ties the other four together-is the keeping of proper records. These need not be elaborate or costly in terms of manpower, but they are essential to maintaining a regular schedule and in providing a running cost summary for every vehicle.

Fuel and Lubricant Selection

The careful selection of fuels and lubricants is vital to any automotive maintenance program. Without the use of fuels and lubricants appropriate to the fleet's operating conditions, a program cannot achieve its goal of economy.

For commercial engines, two grades of gasoline are generally available. (The newer third or super-premium grade is for use in high compression passenger car engines and has little application in the commercial engine field.) The choice of regular or premium for fleet gasoline is dictated entirely by the octane requirements of the engines involved. Little benefit can be obtained by using premium gasoline in an engine which will operate knock-free on regular gasoline. On the other hand, the use of a gasoline of a lower grade than the vehicle requires can result in costly damage: holes burned in pistons, for example.

Two grades of diesel fuel are also available. The choice of kerosene, or No. 1 diesel fuel, and No. 2 diesel fuel is dictated by the service conditions of the vehicle. For lightly loaded equipment in stop-and-start service the more volatile No. 1 grade should be used. Under these conditions there may not be sufficient heat available in combustion chambers to vaporize completely the heavier portions of No. 2 diesel fuel. This results in smoking exhausts and the rapid accumulation of deposits on valves, parts and injectors, with consequent high fuel consumption.

The functions of a lubricating oil in an internal combustion engine are to lubricate, clean, cool, seal and protect. While an oil may have properties which permit it to perform 'these functions under one set of operating conditions, the same oil may show deficiencies if it is used under a different set of operating conditions-even in the same engine.

Because of the wide variety of oil types which were required to provide optimum service from all types of engines in all types of service, it became desirable a few years ago to develop a classification system which would be nationally recognized and by which the correct oil for a given operation could be identified.

The result was the American Petroleum Institute Engine Service

Classification System. Six broad classes of service needs were defined-three for gasoline and three for diesel engines dependent on engine design requirements and vehicle operating conditions. Each service classification is identified with descriptive letters. The letters MS, for example, refer to an oil's suitability for gasoline engines operated under unfavorable or severe conditions. Other gasoline engine service classifications are MM and ML for moderate and light service respectively. Diesel engine service classifications are identified as DS (for most severe), DM and DG for severe and moderate respective-

An important fact of engine lubrication which is often overlooked is that some types of service which are thought of as being very light from the standpoint of engine power requirements, are actually very severe from the lubrication standpoint in that they promote both rapid wear and objectionable deposits. This applies especially to start-and-stop and short-trip service of passenger cars and light trucks in delivery fleets, and to light-load, cold operation of any engine.

In light-load intermittent operation, engine temperatures seldom reach a high enough range to prevent condensation of acidic products of combustion on the cylinder walls. These acids are highly corrosive and their presence results in rapid wear of cylinders and rings.

Raw fuel and water also condense on the cylinder walls and eventually dilute the crankcase oil. The MS type of oil overcomes these contaminants by neutralizing the acids and by keeping solids and water finely dispersed so that they do not agglomerate and settle out in the form of varnish and sludge.

While their principal benefit derives from this minimizing of sludge and varnish in the light-load intermittent type of operation, the newer MS oils have proved equally effective in high-temperature, overthe-road service. The multi-purpose nature of this type of oil contributes to lower fleet operating costs by reducing the number and types of oils stored and handled in the maintenance garage, particularly those organizations with mixed fleets.

Similar cost-cutting benefits may be derived from developments in transmission and differential lubricants, and in chassis greases. In the former, one multi-purpose gear lubricant, the "GL-4 Type," is now widely used for conventional transmissions, all types of differentials and final drives, steering and a variety of other gear components.

For chassis lubrication, the development of multi-purpose lithium soap greases has eliminated the old problem of which special-purpose grease was applied to what point, with all the resulting savings in time and money. Such greases actually surpass the performance level of the old special-purpose greases in most automotive applications.

Lubrication Frequency

Chassis lubrication serves two purposes: It maintains an adequate supply of lubricant to the component at all times; and it flushes out the used grease, together with any solid or liquid contaminants which may have found its way into the bearing.

In transmissions and differentials, the lubricant level should be checked at every inspection. As these oils are not subject to any appreciable contamination they need only be changed seasonally in order to provide the proper viscosity grade for summer and winter use.

Crankcase oil "wears out" primarily because of contamination rather than because the oil itself breaks down. As mileage builds up, the oil's additives become depleted in the course of combating the harmful effects of contamination. Thus periodic motor oil change at reasonable and safe drain intervals is absolutely essential for effective engine protection.

What constitutes "reasonable and safe" drain intervals again depends on the type of vehicle and the service conditions under which it operates. For delivery fleets engaged in light-load, start-and-stop service, the oil should be changed more frequently than is required for trucks engaged in high speed and over-the-road service.

The condition of oil and air filters is an essential element in frequency of lubrication. Air filter maintenance prolongs the useful life of the engine because abrasive material which may be introduced into the engine through improper maintenance has done its "dirty work" long before it reaches the lubricating system where it can be removed by the oil filter. Air-borne abrasives cause serious wear of piston rings, grooves and cylinder walls.

Oil filters are designed to remove relatively large contaminant particles—such as core sand, hard carbon, metal particles—which could damage the engine if circulated through the system. Finely divided contaminants are handled by the crankcase oil's detergent additives. The reason detergent oils darken in color after a short period of use is that these materials are being kept in suspension in the oil, to be drained out at the next change period.

Tune-Up Frequency

In any well-managed fleet, fuel costs are the major item of operating expense. Improving fuel economy only a few tenths of a mile per gallon can result in a savings of many dollars per year to the fleet operator. This is the factor underlying the third vital element of a good preventive maintenance program: the frequency of adjustments made to the fuel and ignition systems of an engine. Such adjustments minimize fuel consumption and permit the engine to deliver its maximum power when required.

The frequency at which adjustments should be made is dictated by the type of service in which the vehicle is engaged. Operations involving frequent stops, starts and changes in engine speed lead to relatively rapid changes in the desired settings. This is in contrast to highway operation where many miles are traveled at relatively constant engine speed.

Inspection is the heart of a preventive maintenance program. It offers dividends far out of proportion to the time invested. It takes very little time to check fuel lines for leaks when the hood is up for lubrication service. If leaks are thus discovered and corrected, fuel economy is improved and a potential fire has been prevented, Similarly, the time required to inspect wheels for looseness while the vehicle is on a lift for chassis lubrication is insignificant. If a loose wheel is discovered, a wheel bearing has been saved or a potential accident

Installing the Program

Drivers can make significant contributions to the success of the preventive maintenance program. The average driver will inspect items affecting his personal safety before he starts a trip. He should also be encouraged to check crankcase and radiator levels. battery, belts and fuel lines, as further insurance against road breakdown. He should be provided with the means to report any unusual conditions he has noted during a trip. This can alert the mechanic and permit him to



Locating Leaky Sewers with SMOKE



■ LIGHTED smoke bomb is placed in intake of blower and smoke is forced into line through manhole at right. Left is smoking manhole; smoke also issues through leaks and improper sewer connections.

C. E. STACY
City Engineer,
McPherson, Kansas

OUR sewage disposal plant was designed for a population of 11,000 and the normal flow is 1.25 mgd. When a heavy rain occurs the flow would increase to over 3.0 mgd. This is not a unique situation because this happens to all disposal plants to some degree, depending on the condition of the sewer mains which serve the plant.

which serve the plant.

To find this infiltra

To find this infiltration, I have had the lines walked after heavy plant flows to find evidence of leaks. Also, manholes were raised above highwater elevations and old covers with holes were replaced with new modern ones. The results of these corrections were fair, but far from complete. Next, cross connections between sanitary and storm sewers were checked, by the use of a Navy dye. This dye, diluted with water, was charged into a storm sewer with a plug at the downstream end. The sanitary sewer was checked at manholes to detect the dye. This method proved only to be labor consuming and expensive. Finally, in discussing my problem with Mr. Stallings and Mr. Seegmueller of Servis, Van Doren and Hazard, consulting engineers, they related the

success that was had with smoke in testing sanitary sewers at the Forbes Air Force Base, and suggested that I try this method. This seemed sound so we gave it a try. After a few alterations of the original method, we have what I consider a very good and inexpensive method for making tests for infiltration. It is so good that I wish to pass it on to city engineers and sanitation superintendents along with compliments of the Servis, Van Doren and Hazard Engineering Company.

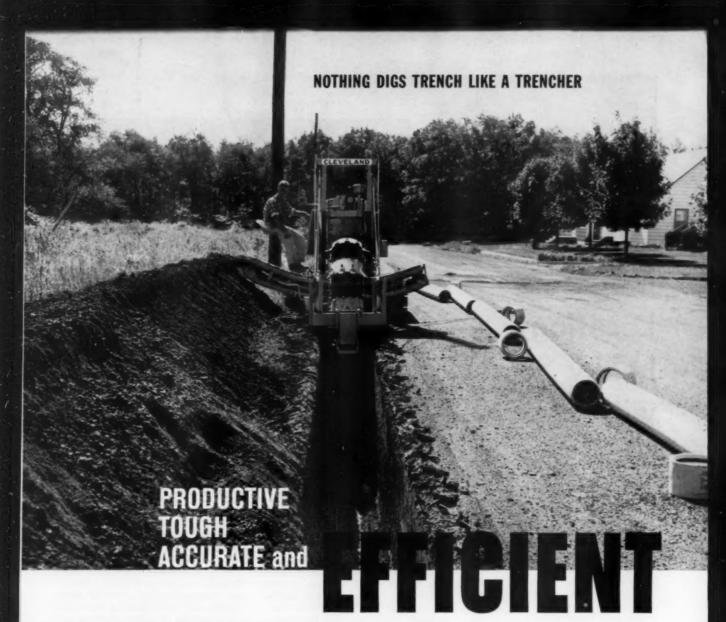
The equipment needed is as follows: 1) A Homelite portable blower, Model 20B, 1500 CFM, or equal; 2) blower connections to manhole, including an 8-in. elbow, a sheet of plywood 3' x 3' x 34"; a sheet of sponge rubber 3' x 3' x 34"; and a canvas air duct with draw strings on each end 8" diameter x 6 ft.; 3) pieces of scrap rubber rug pad and sand bags; and 4) several dozen Superior three minute smoke bombs which may be secured from Superior Signal Company, Inc., South River, New Jersey. The total costs of the above equipment should be less than \$275.

With this equipment, two men, and a pick-up truck you're in the smoking business as long as the bombs hold out. The blower with canvas duct, elbow, plyboard and sponge rubber is set over a manhole. Then the air flow is blocked

with the rubber rug pads at the next upper and lower manholes. With this setup made, the blower is started and smoke bomb lit. Within the next few minutes the sewer leaks will show up as smoke penetrates cracks or holes and follows paths of infiltration to the surface.

Here in McPherson we have over 60 miles of sanitary sewer mains and laterals and have tested over 6 miles and found 23 leaks. We have corrected ten of these which were on the large mains. These repairs on the main line have reduced our influent at the plant to only 1.6 mgd. after a 2-inch rain. This is a more reasonable amount and we believe it will continue to be reduced as the leaks are found and corrected.

In conclusion, the smoking and repairing of our mains and laterals will probably forestall the necessity of a new disposal plant several years. The efficiency of the plant will be greatly improved with the production of good sludge and better effluent. New ordinances will need to be passed providing for an inspection of the capping of abandoned sewer service taps. Also, this smoke test should be carefully considered as a check on new lines before the backfilling operation starts. Smoking sewer lines make the public more conscious of the sewer service that is out of sight and-too often out of mind.



No other type of excavating machine approaches the modern wheel-type trencher in trench digging efficiency. This Cleveland Model 110, for example, dug 500% more trench per day than the other-type excavator it replaced on the 11,000-foot utilities job shown above.

No excavating machine but the trencher is designed especially for trench digging. No other excavating machine compares in trenching productivity with a modern, full-crawler-mounted digging wheel.

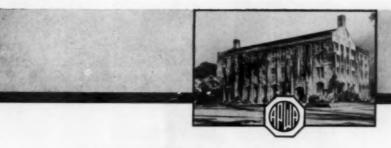
No other excavator cuts trench to such accuracy of line, width and grade. The trencher's accuracy saves extra dirt handling, saves on repaying costs, saves on surplus backfill material. Only Cleveland-type trenchers fine the spoil and place it neatly alongside the trench for fast, simple backfill and better, more complete compaction.

Clevelands dig better trenches, in more kinds of soils, in more terrains, than other-type excavators. They dig more efficiently on trench work of all kinds, on all sizes of trench from 8 inches to 52 inches wide. They dig down to 8 feet 10 inches deep and slope trench up to 12 feet wide across the top.

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NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Erickson Named Regional Director

David L. Erickson, director of public works and utilities for Lincoln, Nebraska, has been appointed to serve as Director of Region 6 of the Association, to fill the vacancy in this office created by the election of Edward J. Booth, city engineer, Bismarck, North Dakota, as Association Vice-President. The appointment was made by the Association's Board of Directors during the 1961 Congress and Equipment Show at Minneapolis.



National Public Works Week Proclaimed

Governor Robert B. Meyner of the State of New Jersey affixes his signature to a proclamation naming the week of October 1-7, 1961 as "National Public Works Week." The picture above typifies ceremonies enacted in many State Capitols and City Halls, as proclamations were issued to mark that week as a tribute to public works engineers and administrators. Shown with

Governor Meyner are (seated) Charles A. Koenig, governor of the New Jersey Kiwanis, and Arthur T. Brokaw, borough engineer of Princeton and President of the New York-New Jersey Metropolitan Chapter. Standing are Raymond F. Male, commissioner of Labor and Industry for the State of New Jersey and Mayor of Princeton; Mersey and Mayor of Princeton; Mervin Flock, lieutenant governor of the New Jersey Kiwanis; and Edward P. Decher, past national president of the APWA.

Mr. Erickson has held his present position with the City of Lincoln since 1954. His service with the city started in 1911. For a six-year period he was Deputy County Engineer for Lancaster County Nebraska, returning to an engineering position with the city in 1923. As director of public works and utilities he has supervision of the Water and Light Department, streets, sewer and paving repairs engineering, building inspection and plumbing inspection. One of his major contributions to the field of public works has been the planning, design, construction and operation of Lincoln's water supply system.

In addition to membership in the APWA, Mr. Erickson has served as a past national director of the ASCE and the AWWA. He is a member of ARBA and other engineering and professional societies.

Top Ten Public Works Men-Of-The Year

Ten public works officials from a large field of nominees have been named as the outstanding men in their field. The announcement, made at the 67th Annual Meeting of the American Public Works Association, is part of a nation-wide effort to honor these and other public works officials at the local, state and federal levels.

Selected this year were: David V. Auld, director of sanitary engineering, government of the District of Columbia; Henry A. Barnes, commissioner of transit and traffic, Baltimore, Md.; Hugh A. Benner, director of public works, Saginaw,

OFFICERS: Albert G. Wyler, New Orleans, La., President; Edward Booth, Bismarck, N.D., Vice President. REGIONAL DIRECTORS: (term ending 1962) Paul R. Screvane, New York, N. Y.; Manon P. Phillips, Augusta, Ga.; David L. Erickson, Lincoln, Nebr.; (term ending 1963) George J. Maher, Lewiston, Maine; Robert S. Hopson, Richmond, Va.; Harlan H. Hester, Fort Worth, Texas; (term ending 1964) Lloyd D. Knapp, Milwaukee, Wisc.; John A. Lambie, Los Angeles County, Calif.; Roy W. Morse, Seattle, Wash. Immediate Past President, Frederick W. Crane, Buffalo, N. Y. Robert D. Bugher, Executive Director.



Mr. Aule



Mr. Barn



Mr. Benner



Mr. Bugge



Mr. De Ment



Mr. Hess



Mr. Lee



Mr. Maier



Mr. Vincenz



Gen. Welling

Mich.; William A. Bugge, director of highways, State of Washington; George De Ment, commissioner, department of public works, Chicago, Ill.: Robert H. Hess, director of water and sewage treatment, Wichita, Kansas; David B. Lee, director of sanitary engineering, Florida state board of health, Jacksonville, Fla.; Eugene Maier, director, department of public works and engineering, Houston, Tex.; Jean L. Vincenz, director of Public works, San Diego County, Cal., and Brig. Gen. Alvin C. Welling, commanding general, corps of engineers ballistic missile construction office, Los Angeles, Cal. Details on the specific accomplishments and the careers of these ten officials appeared in the October issue of Public Works.

Charles Walter Nichols Award

For the first time two men have been named co-recipients of the 1961 Charles Walter Nichols award. Ed F. Muckelroy, superintendent of the department of sanitation, El Paso, Texas, and Abraham Michaels, deputy street commissioner in charge of sanitation, Philadelphia, Pa., were cited for their achievements in the sanitation field and will share the \$500 honorarium which goes with the award.

Michaels award was for the use of sound engineering and public administration practices in the construction and operation of the Philadelphia Northwest incinerator. The \$10 million project has gained a reputation for efficiency, cleanliness, and aesthetic beauty. Its engineering aspects feature the integral design of combustion, materials handling, ventilation and site conditions

Muckelroy was cited for management of a waste disposal system and sanitary landfill operation in El Paso, which has preserved property values and made excellent use of available land. When waste disposal was no longer possible in this area, Muckelroy's research and ingenuity contributed to development of a unique transfer system for refuse to a more distant area, at considerable savings in manpower and money.

The award was established in 1951 by a grant from Charles Walter Nichols, Sr., of Nichols Engineering and Research Corporation.

Greeley Award Winners

Thirty-two public works officials with 30 or more years of service to their communities have been named as recipients of the Samuel A. Greeley service award.

The award, founded in 1937 by a Chicago consulting engineer firm executive, was announced at a special luncheon, held in Minneapolis on Tuesday, September 26.

The following individuals received the Greeley award this year: Arthur D. Bird, city engineer, Cincinnati, Ohio; Donald S. Boreham, assistant commissioner of commerce for marine and aviation services, Government of the Virgin Islands; James A. Brophy, street commissioner, Madison, Wisconsin; H.

James Cassidy, public works coordinator, Los Angeles, California; Fred A. Cooper, garage and shop superintendent, Ft. Worth, Texas; Whitworth Cotten, city engineer, Petersburg, Virginia; Thomas H. Cousins, superintendent, public works department, St. James, Manitoba, Canada; Carl Gailey, superintendent, highway maintenance, Cincinnati, Ohio.

Roy I. Gentry, director of public service, Knoxville, Tennessee; Edward P. Hart, director of public works, Highland Park, Illinois; Waldo W. Hill, city engineer, Augusta, Maine; William D. Hurst, city engineer, Wilnipeg, Manitoba, Canada; John B. Kozlik, garage superintendent, Irvington, New Jersey; Alvin J. Kuecker, director of public works, Elgin, Illinois; William F. Mains, supervisor of incinerators, Cincinnati, Ohio; Phillip J. Martin, Jr., water systems manager, Tucson, Arizona.

Leo R. Mathews, superintendent, Three Rivers filtration plant, Ft. Wayne, Indiana; John E. Meade, deputy director of public works, Providence, Rhode Island; Kerwin L. Mick, chief engineer and superintendent, Minneapolis-St. Paul Sanitary District; Eugene F. Mulligan, deputy chief of staff for operations, division of street cleaning and waste disposal, New York, New York; Martin P. O'Connel, assistant chief of staff, bureau of cleaning and collection, New York, New York; William A. Ostrem, sewer engineer, Minneapolis, Minnesota;



Architects and Engineers / Bail-Horton & Associates, Fort Myers, Florida

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Archie Parkes, supervisor, department of public improvements, Birmingham, Alabama; Anton Pav, commissioner of public works, Berwyn, Illinois.

Robert C. Pegues, director of engineering and administrative services, Memphis, Tennessee; Carlos Valle-Riestra, assistant city engineer, Beverly Hills, California; Frederick T. Roche, superintendent of streets and sewers, W. Springfield, Massachusetts; Percy S. Sankey, principal accountant, city engineering department, Seattle, Washington; Harry E. Turner, secretaryforester, shade tree commission, East Orange, New Jersey; H. Ward Tyler, principal engineer, Seattle, Washington; Samuel E. VanLieu, assistant superintendent, waste collection division, Cincinnati, Ohio; and William E. Weigle, city engineer, York, Pennsylvania.

1962 Western Area Conference

The Southern California Chapter of the American Public Works Association will hold its biennial Area Conference Western Equipment Show starting May 30, 1962, at the Hotel Lafayette in Long Beach. The event, scheduled to last through June 1, will be an educational program for public works personnel, governmental administrators, contractors, and utility, equipment, and material workers. The Show will display the latest developments in the field of public works administration.

Working demonstrations of the newest equipment in the field, along with recent advances in materials, methods, and practices, will cover six acres of ocean-front display space. Featured event on the program is a harbor tour of Long Beach, during which APWA members will study the city's progress in conquering subsidence problems.

Missouri Chapter Holds Annual Elections

The Missouri Chapter of APWA held its annual meeting on September 29 in Clayton, Missouri in conjunction with the annual meeting of the Missouri Municipal League. Herbert G. Poertner, public works director, St. Louis County, was elected to serve as Chapter President for the 1961-1962 year. Vice President is Walter G. Myers, assistant city engineer, Kansas City; Joseph Schulte, Jr., director of public works, Florissant, was named Secretary-Treasurer and Clarendon Rea, commissioner of refuse col-

lection, Kansas City, and Louis Hachtmeyer, street commissioner, St. Charles, were elected as Directors.

San Diego and Imperial Counties Chapter

The San Diego and Imperial Counties Chapter of the American Public Works Association held its annual meeting on September 21, with approximately 90 people attending. The program, chairmaned by Lane F. Cole, city engineer, La Mesa, dealt with "Public Works Function in Cities Less Than 50,000 Population." The engineering and public works people from seven of the eleven incorporated cities in San Diego County discussed particular phases of their public works function.

Officers elected for the ensuing year were: President: Edward F. Gabrielson, city engineer, City of San Diego; First Vice Pres.: J. Frank Jorgensen, assistant district engineer, State Division of Highways; Second Vice President: Lane F. Cole, city engineer, Chula Vista; and Secretary-Treasurer: V. L. Larson, Right of Way Supervisor, Pacific Telephone. Elected to the executive committee were David K. Speer, county surveyor and road commissioner, County of San Diego; E. T. Cleaver, assistant chief Right of Way Agent, San Diego Gas and Electric; J. M. Johnson, Public Relations, Daley Corp.; M. J. Shelton, Koebig and Koebig, Engineers; and Joe E. Rushing, principal civil engineer, Department of Public Works, County of San Diego.

Aluminum Conduit for George Washington Bridge

Fifteen miles of Alcoa aluminum, in the form of electrical rigid conduit, will house the signal and lighting circuits of the new lower level roadway of the George Washington Bridge, now under construction.

A total of more than 80,000 feet of lightweight, corrosion-resistant conduit is being installed as part of the project to construct the lower level. Capacity of the Upper Manhattan-New Jersey link will be increased 75 percent when the six-lane lower roadway is opened to traffic in 1962—31 years after the upper roadway was completed. Entire project — bridge and approaches—will cost about \$183-million.



Under construction, a complete city for living—and working! When Palm Beach Gardens, Florida, is completed, it will be a self-contained city of 15,000 homes ...plus industrial plants, schools, churches, shopping center, golf course, landing strips for aircraft, and miles of man-made rivers.

Florida's largest landowner selects "K&M" Asbestos-Cement Pressure Pipe for his "city of the future"

An ultra-modern "city of the future" is rising out of the fertile Florida loam, a few miles northwest of West Palm Beach: Palm Beach Gardens.

The daring and vision behind Palm Beach Gardens belongs to Mr. John D. MacArthur, Chicago insurance executive with a wide range of commercial interests.

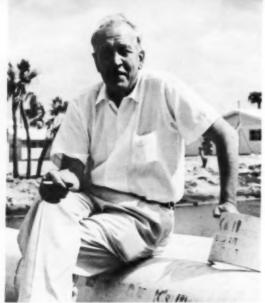
No effort is being spared to insure homeowner satisfaction: one-acre lots, homes ranging from \$9,000 to \$30,000, fully mature trees as well as new plantings and all community

services. For example, mountain spring water from Georgia, filtering through a hundred miles of underground gravel, will reach homes via "K&M"® Asbestos-Cement Pressure Pipe.

Mr. MacArthur has already installed 80,000 feet of 4" through 16" "K&M" Asbestos-Cement Pressure Pipe... plans to install another 600,000 feet, within the next two years.

Mr. MacArthur and his advisers studied water piping of all kinds, and in his own words:





Mr. John D. MacArthur, president of Bankers Life & Casualty Company, Chicago, Ill., and builder of Palm Beach Gardens, Florida.

"Creating a new city is a great responsibility. The actual needs of the future generations can only be projected with imagination. Obviously the mistakes of our generation must be avoided. A system of streets anticipating the traffic flow, adequate parking, and a utility system built large enough to handle the maximum future requirements are essential. We selected 'K&M' Asbestos-Cement Pressure Pipe for our water lines only after my advisers had studied all available materials both domestic and foreign. We believe the coming generations will be spared the cost of repairs and replacements and our judgment will

There are good reasons for Mr. MacArthur's confidence in "K&M" Asbestos-Cement Pressure Pipe. It's nearly maintenance-free because it won't tuberculate, resists corrosion, and is immune to electrolysis. In addition, the exclusive, patented

"We chose 'K&M'
Asbestos-Cement
Pressure Pipe over all
available materials,
foreign and domestic"

"K&M" FLUID-TITE® Coupling assures water-tight joints under all operating conditions.

As a result, taxpayers will enjoy the same water pressure and flow years hence, as they do now. Pumping costs through the years will remain low. Upkeep will be minimum. These tax savings will continue not only during the lifetime of present citizens, but for generations to come.

Discover why progressive communities from coast to coast choose "K&M"

As bestos-Cement Pressure Pipe. Write to: Keasbey & Mattison Company, Ambler, Pa.





Two easy steps will connect the pipe length to the FLUID-TITE® Coupling! Just lubricate and slide the pipe in. No heavy coupling pullers or machinery needed. Joint is permanently leak-tight.



"K&M" Asbestos-Cement Pressure Pipe installs swiftly and easily. In fact, you can lay it as fast as a shovel digs. Weather and soil conditions can't halt you. Lengths are easy to handle, You save time and labor costs.

In Tacoma ... PEDESTRIANS RIDE

N 1958 THE citizens of Tacoma passed a \$3,923,000 bond issue for street and bridge improvements recommended by the Citizens' Committee for Tacoma's Future Development and approved by the City Council. The improvement program included plans for the installation of pedestrian escalades in the Central Business District.

Two of four pairs of "moving side-walks" are now in operation, Unit "A" dedicated February 27, 1961, and Unit "B" opened May 1, 1961. Construction is proceeding on the other two units which will be in operation later this year. The escalades provide enclosed moving belt pedestrian passageways between hill streets at the mid-block closurions of 625-foot long blocks, eliminate burdensome hill climbing and are expected to provide a stimulus to businesses near their locations.

The 42-in. width of the special rubber belt, grooved for improved traction and drainage, allows two pedestrians to travel abreast. The threshold at both the entrance and exit points are fitted with comb plates which will ride in the grooves of the moving belt. The belt rides on a stainless steel slider plate and is powered by a 30 hp motor in the upward direction and a 15 hp motor in the down direction. Each installation will be equipped with inclined balustrades with a vinyl type finish and moving handrails. Each pair of moving sidewalks will be housed in a single tunnel with the up and down walkways being separated by the moving handrails which are set approximately 18 inches apart.

Safety

The safety of every person who might have occasion to use the moving walks has been provided for by including special safety devices. A safety device is provided to insure the automatic stopping of the equipment if any foreign object becomes caught in the threshold plate or at the ends of the moving handrails. This consists of a micro switch to cut the power to the motors, if such



 ESCALATORS in hilly section of Tacoma are located at mid-points in long blocks to facilitate passage of pedestrians to upper-level streets and retail shopping areas.

an event should occur. The installation also includes a second micro switch set to engage if for any reason the first one fails to operate. To avoid too sudden a stop, in the event of a shut-off of the power to the machinery, there is a provision for an adjustable stop on the moving belt that can be varied from zero to eighteen inches of travel after power is shut off.

A contract for maintenance and lubrication service on Units "A" and "B" was signed with the equipment installer, Montgomery Elevator Company of Tacoma, Washington, This service will be provided at a total cost of \$156 per month for both units. The contract will run until the end of the year at which time City personnel will be used to service the escalades.

Use Survey

The locations of the moving walks had been selected to be approximately at the center of double length blocks to increase the free circulation of pedestrian traffic in the heart of the downtown central

business district. To gather information to support the theory that these moving walks would be extensively used, and also as background information for negotiating severance damages to the properties in these locations, an actual usage study was conducted by the Traffic Engineering Division of the Department of Public Works. The basic data for this study was obtained by means of a field survey employing four interviewers and four count men for two days. The interviewers recorded a total of approximately 1600 individual interviews regarding preference for the moving sidewalk plan. In addition, the pedestrians' origin and destination were also noted. The 1600 individuals were from a total count of 10,700 pedestrians passing the interview station. The results of the survey indicated there would be approximately a 40 percent increase in pedestrians adjacent to the mid-block location of the moving sidewalks and therefore substantial increase in potential customers for the businesses near these locations.

Marked Growth in Public Works Planning

PERE F. SEWARD

Deputy Commissioner.

Community Facilities Administration, Housing and Home Finance Agency

N OTABLE increases in the volume of applications for Federal assistance in the preparation of working plans and specifications for needed local public works have been evident since the White House made public last spring its anti-recession policy. Applications continue to pour into the Regional Offices of the Community Facilities Administration, which administers the program under the Housing and Home Finance Agency, and public works projects promise to become a significant factor of the construction economy during the early '60's.

Congress, in the Housing Act of 1961, increased the authorization for the program of advances for public works planning by \$10,000,-000, thus providing \$58,000,000 for CFA's continuing revolving fund. While this amount seems small in the face of the tremendous deficit in needed public works, it can be used again and again through the careful selection of projects to assist communities in their efforts for orderly and sound development. Advances are repaid when the applicant starts construction work.

The goal for catching up probably will have to be projected far into the future, but a dent into the multi-billion-dollar backlog is presently discernible. For instance, during the first seven months of 1961, Community Facilities Commissioner Sidney H. Woolner announced advances aggregating \$9,-

801,584 for 265 projects to cost an estimated \$555,462,384. Of these, 156 were for sanitation works to cost \$312,558,000 for which \$5,002,000 was advanced to applicants. By type, the projects approved between January 1 and July 31, are shown in Table 1.

There are still very large deficiencies in water systems, sanitary sewers and sewage treatment facilities. In 1958, a survey made by the U. S. Public Health Service disclosed that some 50 million persons are served by sanitary sewers without adequate treatment facilities while some 40 million need new or improved sewage collection systems. The Business and Defense Services Administration stated in the same year that 117 million using public water supplies cannot be sure of having enough water available on a hot summer day to put out a major fire.

The principle of assistance for public bodies with the advance of interest-free funds for planning needed useful utilities has resided within the Community Facilities Administration since the initial program was authorized in 1944 as Article V of the War Mobilization and Reconversion Act. In this, and in the two succeeding programs, CFA advances totaling \$107,547,000 to finance studies, surveys, drawings, blueprints and cost estimates have been made available for 9,462 public works projects. These involved expenditures of \$2,750,000,000 and most of these utilities were brought to the point of contract bidding long ago and are now returning efficient public service to their respective communities

With plans completed by qualified

engineers and architects, cities and towns, special districts, counties, and other non-Federal public bodies found they could go into the capital market and obtain financing for their projects. Another significant consideration rested in the fact that with the completed plans on view, voters have been persuaded in growing numbers to approve essential bond issues.

Back of the establishment of the advance planning legislative formula there was a long story of makeshift, patching and improvisationand public works improvisation can prove to be a slipshod and costly business. There were work relief projects by the PWA and WPA in the depression, but in the war years, when manpower and materials were needed to implement the fighting forces, and in the first years of the peace when a frugal sort of austerity touched the building market to divert all efforts into providing home shelter for the returned GI's and their families, public works construction was definitely cut down and, too often, out.

The first advance planning program was set up to provide a reserve shelf of public works which could be submitted to prompt contract bidding to provide work when the war plants closed and the soldiers returned from overseas.

Congress authorized the first program of non-interest bearing advances for public works program, and more than 6,000 projects were earmarked for planning assistance. When the looked-for hard times did not show up, however, the program was allowed to expire but not until many in and out of government had been convinced that invaluable lessons had emerged from it. Congress subsequently has established two other programs for interest-free advances for public works.

As a result, scores of small communities have successfully decentralized industry and brought in new business. It has been demonstrated that this planning program can inject a vital economic force into many forward looking localities.

A list of essential public works projects approved for planning advances between January 1 and July 31, is shown in Table 2 which appears on pages 144 to 148.

Table 1—Public Works Advances Approved, Jan. 1 to July 31

Projects		Advance	Estimated Cost
Sewer	114	\$2,520,041	\$146,412,422
Water	39	2,277,738	160,148,140
Other Sanitation	3	204,673	5,998,203
Hospitals	7	119,600	8,075,338
Schools	46	1,046,348	52,543,717
Public Buildings	17	2,034,404	110,516,673
Streets	9	134,344	5,579,379
Miscellaneous	27	1,286,436	54,772,512
Bridges	3	178,000	11,416,000
	265	\$9,801,584	\$555,462,384



MODEL DAM BY R. S. BALDWIN

When it comes time to appoint a trustee or fiscal agent for revenue bonds, The Chase Manhattan Bank is at the service of state, county and municipal authorities. Chase Manhattan has the staff and experience to handle this function as trustee or fiscal agent in cooperation with banks in the areas where the projects are located. For complete details write: Corporate Trust Division, The Chase Manhattan Bank, 1 Chase Manhattan Plaza, New York 15.

Table 2—Projects Approved for Planning Advances from the Community Facilities Administration (January 1 through July 31, 1961)

Location		Est. Cost n \$1000's)	Location		\$1000's
ALABAMA			GEORGIA		
	Conitons source	775	Quitman	Sewer extensions	658
Bayou La Batre	Sanitary sewer Outfall sewer	162	Quitinan	Water system imps.	299
Montgomery		475		water system imps.	230
	Outfall sewer, force main	76	HAWAII		
	Outfall sewer, lift station	76	Hilo	Sewer system	850
ALASKA			HILINOIS		
Juneau	Street, bridge improvements	1,215	ILLINOIS	Caritany saves system	160
	Sewage collection system	200	Ava	Sanitary sewer system	
	Storm, sanit, sewer exten.	950	Argenta	Sanitary sewer system	253
	Parking facilities	765	Charleston	Water treatment fac.	485 325
Ketchikan	Electric power sys. imps.	1,283	Galva	Sewer system ext.	457
ARIZONA			Lake-in-the-Hills V	Sanitary sewer system	201
Mammoth	Conitons course system	245	Lakemoor	Water distribution	99
mammoth	Sanitary sewer system	243	Lakewood	Water distribution	294
ARKANSAS			Livingston	Sewer sys., treatment fac.	
Ashdown	Treatment plant	140	Lovington	Sanitary sewer system	400
Bradley	Sewer & treatment facilities	130	Oakland	Water system imps.	199
McRae	Water-sewer facilities	100	Woodhill	Sanitary sewer system	206
CALIFORNIA			INDIANA		
	Water supply, storage sys.	605	Terre Haute	Sewer system improvements	2,826
Amador County	water supply, storage sys.	003	TOTTO THUMB	outer oyeum improvement	-,
Arroyo Grande & Grover City	Flood control, storm drainage	1,003	IOWA		
	Highway grade separation	1,008	Evansdale	Sanitary sewer facilities	1,674
Bakersfield		620			
Banning	New sewers, treatment fac.	1,185	KANSAS		
Cambria	Sanit. sewer system		Burden	Sanitary sewer system	121
Clearlake Oaks	Water system extensions	300	Carbondale	Sanitary sewer system	126
Coalinga	Sewage treatment facilities	277	Copeland	Sanitary sewer system	103
Hanford	Sewer facilities	1,500	Dighton	Sewer system improvements	74
Keyes	Sewer system, disposal plt.	190	Hutchinson	Water system improvements	3,018
Livingston	Sanit. sewer system	400	Ingalls	Sewerage facilities	65
Marysville	Sewage treatment plant ext.		Lebanon	Sanitary sewer system	126
	Storm drainage	800	Longford	Sewerage facilities	59
Pinedale	Sewer lines, disposal sys.	450	Lorraine	Sewerage facilities	47
Placer County	Water & power facilities	122,100	Manhattan	Water system extensions	830
Rolling Hills			Norton	Water system improvements	305
Estate	Street improvements	1,096	Riley	Sewerage facilities	150
San Luis Obispo	Sewage treatment imps.	993	Sabetha	Park & recreation fac.	114
	Water distribution system	8,000	Wakeeney	Sewerage facilities	152
Santa Clara Co.	Water treatment facilities	6,840			
Seaside	Storm sewer system	560	KENTUCKY		
CONNECTICUT			Monticello	Sewage collection system,	
East Hampton	Water facilities	1,355		treatment plant imps.	509
New Haven	Treatment plant imps.	3,660	Mount Vernon	Sanitary sewer system	355
	The state of the s	-,	LOUISIANA		
COLORADO			Delcambre	Sewer sys., treatment plt.	400
Denver	Sewage treatment system	29,000	Delcambre	Street, drainage improvements	
Lafayette	Water system imps.	388	0:	Sewerage facilities	1,380
	Sewage treatment fac.	170	Garyville		1,721
Sheridan	Street improvements	455	Gretna	Incinerator	
FLORIDA			Mamou	Water system	129 26
	Sewer & water facilities	550		Sewer system expansion	103
Mary Esther		552		Two swimming pools	
Melbourne	Sewer system extensions	1,450	Morganza	Sanitary sewer system	183
Orlando (This project ico	Drainage & water control	3,712	Reserve	Sewerage facilities	1,350
	ludes Winter Park and Lake Mai		St. Charles	Drainage facilities	2,978
Safety Harbor	Water & sewer extensions	600	Zacho	Sewer sys. for 5 communities	2,338
St. Cloud	Sewer system additions	395	Zachary	Water system extensions	170
Springfield	Water system extension	600			
Winter Haven	Storm drainage & water cont		MAINE	war and a second second second	t. 258
	system	2,480	Mars Hill	Sewerage and sewage treat, p	

- Continued on page 146











There's a LEECE-NEVILLE ALTERNATOR to match any job requirement

Leece-Neville manufactures more than 300 different alternators—each designed to provide adequate electrical power, save batteries, eliminate downtime and cut maintenance expense. One or more of these is "just right" for your type of vehicle in your type of service. Range of alternator models—all reversible—includes 6, 12, 24 and 32 Volt positive or negative ground types from 40 to 150 Amperes. Sales and service are readily available through

more than 1200 L-N Service Distributors strategically located in the U.S. and Canada. Leece-Neville alternators and other electrical equipment can be specified as factory-installed equipment on most new vehicles. For more information—or for assistance in specifying the correct alternator for your vehicle and service requirements—just mail the coupon at the right.



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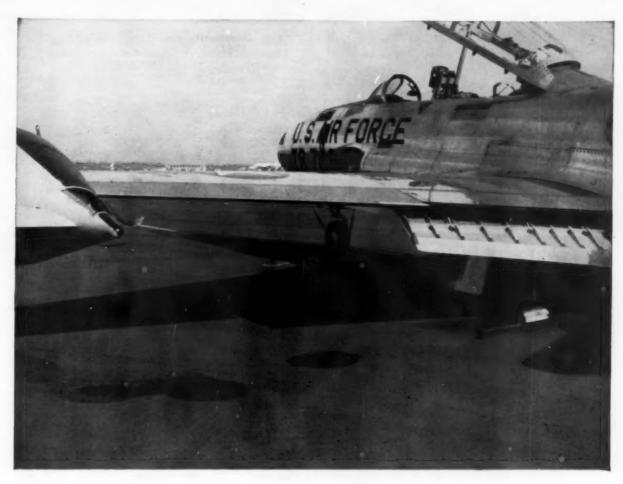






Table 2—Projects Approved for Planning Advances from Community Facilities Administration (January 1 through July 31, 1961)

Location		st. Cost \$1000's)	Location	Project (i	Est. Cost n \$1000's
MAINE (Cont.)			Gloversville	Sewer system improvements	2,195
Rumford	Sewerage and sewage treat, pli	1.245	Hamburg	Storm drainage system	1,767
Wells	Sewerage and sewage treat. p			Sewer sys., treatment plt.	1,804
York County	Sewerage and sewage treat pli	t. 542	Livingston Manor	Sewer sys., treatment	282
MARYLAND			Niskayuna	Sewer sys., treatment fac.	1,641
Annapolis	Storm drainage system	3,154	Plattsburg	Complete water system	435
Anne Arundel Co.	Storm drainage system	1,328	Poughkeepsie	Sewer system improvements	2,525
Aille Ardilder Co.	Storiii dramage system	1,520	Rockland Co.	Sewer extension, treat.	12,000
MASSACHUSETTS			Sloatsburg	Sewer sys., treatment	778
Fitchburg	New water facilities	390	Sullivan Co.	Mongaup River bridge	400
Yarmouth	Sewage treatment	1,750	Troy	New water facilities	7,510
			NORTH CAROLINA		
MICHIGAN	Water Karilikian	49	Bessemer City	Sewer & Water facilities	298
Howell	Water facilities	213	ОНІО		
Nashville	Sanitary sewer facilities	276	Aberdeen	Sewer system & treatment	280
Oakland Co.	Sewer system extensions	2,336			5,180
Rockford	Sewage disposal system Water system improvements	319	Bridgeport	Sewage facilities	3,100
St. Clair Shores	Storm sewerage facilities	618	OREGON		
or orall shores	Diversion drain project	689	Brownsville	Sanitary sewer system	258
Wayne County	Incinerator	2,678	Cave Junction	Sanitary sewer system	81
,		2,0,0	Manhattan Beach	Sanitary sewer system	145
MINNESOTA			Multnomah Co.	Trunk sewers	288
Mound	Sewerage & treatment fac.	1,324	Newport	Sanitary sewer system	344
	Water system improvements	311	Oregon City	Complete water system	674
MISSISSIPPI			Silverton	Sanitary sewer sys. imps.	255
Beaumont	Complete water system	136	PENNSYLVANIA		
Deadmont	Complete water system	130	Jacobus	Water system improvements	90
Charleston	Sewerage system extensions	247	Johnstown	Sanitary sewer system	790
Forrest Co.	Water and sewer imps.	1.337	Latrobe	Sanitary sewer improvements	3,044
Nettleton	Water and sewer facilities	390	Leesport	Sanitary sewer system	740
Tishomingo	Sanitary sewer system	116	Nanty-glo	Sanitary sewer improvements	748
Tupelo	Water supply sys. adds.	965	New Oxford	Storm sewer	90
•	Sewer system imps.	1,490	Parker	Sanitary sewer system	440
MICCOLLDI			Southampton	Sanitary sewer system	3,700
MISSOURI	Alam anna anna	000	Temple	Sanitary sewer system	610
Huntsville	New sewer system	222	Topton	Sanitary sewer system	970
MONTANA			Whitehall Twp.	Sanitary sewer system	3,800
Beit	Sanitary sewer system	221			
Chester	Water system improvements	318	RHODE ISLAND	Complete water system	1,156
Hamilton	Trunk storm drainage	240	East Greenwich	Complete water system	1,130
Harlem	Street improvements	393	SOUTH CAROLINA		
Saco	Sanitary sewer system	75	Aiken	Storm sewers	1,000
				Sewer system extensions	1,500
NEW HAMPSHIRE			Ninety-Six	Sewer system extensions	318
Ashland	Sewerage & treatment plant	517			
Exeter	Water system	310	TENNESSEE		-
Manchester	Sewerage & treatment plant	12,500	Jellico	Street improvements	79
Nashu a	Sewerage & treatment plant	1,200	White Pine	Sewer system, treatment	257
NEW JERSEY			TEXAS		
Dover Twp.,	Sewer collection lines		Eden	Street improvements	180
Ocean County	treatment plant	3,165	Port Mansfield	Water system	567
Newark	Pumping station imps.	2,900	Sabine and	Complete sewerage system	
N. Brunswick	Water facilities	1,461	Sabine Pass	both towns	305
Middlesex Co.,		-,	Sabine River	Dam and reservoir for wa	
Pompton Lakes	Sewer system, treatment	1,725	Authority	supply, hydroelectric pow	
Trenton	Incinerator & garage	1,600	riacitoticy	navigation and recreation	
				Texas and Louisiana	60,000
NEW YORK			Sansom Park	Street imps. & storm drainage	
Colonie	Sewer sys., treatment plt.	2,227	Victoria	Storm drainage system	1,866
Erwin	Sewer sys., treatment plt.	780		Street improvements	2,471



Fuel-resistant Koppers Pavement Sealer ends ramp problem at Scott Air Force Base

The jet age has posed a serious pavement maintenance problem for modern airports: Asphalt ramp surfaces, used for refueling and service work, are extremely vulnerable to deterioration from the solvent action of high grade jet fuel and lubricants.

Scott Air Force Base, located at Belleville, Illinois, has encountered this problem—compounded by mechanical damage from the pivoting and turning movements of jet wheels over the softened pavement.

Maintenance engineers at Scott AFB supervised the application of Koppers Pavement Sealer to give these surfaces a permanent, fuel-resistant cover. Before application of the Sealer, all cracks were repaired, softened areas were cut out and patched, and all surfaces were cleaned with a detergent solution. Two separate coats of Pavement Sealer were applied—13,000 gallons in all—with an appropriate mixture of sand to provide a long-wearing, non-skid surface.

Numerous other air bases and airports have used Koppers Pavement Sealer to protect their service areas and runways against deterioration from petroleum spillage. Koppers Pavement Sealer meets all Federal specifications and Air Force requirements.

For more information on how Pavement Sealer can help you solve your pavement maintenance problems, write Koppers Company, Inc., Pittsburgh 19, Pa., or send the coupon. District Offices: Chicago, Los Angeles, Pittsburgh, New York and Woodward, Alabama. In Canada: Koppers Products, Ltd., Toronto, Ontario.



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You just can't beat a Weinman Pump for money-saving, dependable public service. It will pay you to consult your Weinman Pump Specialist whenever you have a pumping problem.



For the advice of experience . . . look him up in the Yellow Pages ... or write direct for Bulletin 1200.



Continued from page 146-

Table 2—Projects Approved for Planning Advances from the Community Facilities Administration (January 1 through July 31, 1961)

Location	Project (i	Est. Cost n \$1000's
UTAH		
Layton City	Storm sewer system	241
Moab City	Sewer system improvements	242
	Water supply sys. adds.	446
Ogden	Storm sewer system	1,500
Roy	Storm sewer system	610
Sunset City	Storm sewer system	299
Wasatch and Carbon Counties	Dam on White River to prov supplemental water for Pr Helker, Wellington and Cas	ice, stle
	Gate communities	514
VERMONT		
Bethel	Sewer system & treatment	350
Montpelier	Sewer system & treatment	1,495
Poultney	Sewer extensions, treatment	300
Woodstock	Sewer extensions, treatment	550
VIRGINIA		
Norfolk County	Sanitary sewer system	2,264
	Sanitary sewer system	1,700
Stephens City	Sewer system, oxidation pon-	d 165
WASHINGTON		
Birch Bay	Water facilities	628
Blaine	Water sys. improvements	65
	Sewer sys. improvements	314
Goldendale	Water system imps.	202
	Sanitary sewer system	114
Mount Vernon	Water system	935
Mukilteo	Water system	284
Seattle	Sewage treatment fac.	17,262
Sumner	Storm drainage imps.	233
Tacoma	Highway bridge	3,000
	Storage facilities	1,000
Washougal	Sanitary sewer system	800
Waterville	Highway system imps.	1,000
WEST VIRGINIA		
Follansbee	Water system	341
Harrison County	Water distribution	107
Wierton	Water treatment plant	1,250
	Water system extension	1,250
WYOMING		
lackson	Street improvement	240
	Water treatment & storage	226
Natrona County	Sanitary sewer system	375

Garbage Collection and Disposal in Milwaukee

Combustible refuse collected by the Bureau of Garbage Collection and Disposal of Milwaukee during 1960 amounted to 129,714 tons. Collections averaged 5.153 tons a day per crew. The per ton cost for collection of garbage and combustible material amounted to \$22.35. Total expenditures were \$2,901,031.

Combustible refuse burned amounted to 132,593 tons in 1960, an increase of 7.42 percent over the 1959 figure. The incineration load varied from a high of 676 tons per day in April to a low of 384 tons per day in December. The overall average for the year was 542.3 tons



CHATTANOOGA CHOOSES Shown here is the original Jeffrey sewage treatment equipment installed at Chattanooga. JEFFREY Recently, the city expanded its treatment capacity, ordered almost identical Jeffrey equipment. Havens & Emerson of Cleveland, Ohio and New York City SEWAGE TREATMENT were the engineers. Shown above are the primary settling tanks featuring the Jeffrey tank drive units designed especially for sewage treatment plant service. Shown below are the power-driven scum skimmers with long-wearing Jeffrey sprocket, chain and flight assemblies. Jeffrey's Sanitary Engineering Division offers complete technical assistance in designing and equipping water, sewage and industrial waste

treatment installations. For further information, write today for Catalog 952, The Jeffrey Manufacturing

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Water Supply and Waste Disposal

W. A. Hardenbergh and E. B. Rodie



503 Pages

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CONTENTS

The Water-Sewage Cycle; Quantity of Water from Rainfall; Water Use and Sewage Volume; Hydraulics of Water and Sewage Conduits; Piping for Water and Sewer Systems; Collection and Storage of Water; Water Distribution; Collection and Transportation of Sewage; Pumps and Pumping; Examination of Water and Sewage; Water Treatment by Screening and Sedimentation; Filtration; Disinfection; Removal of Dissolved Minerals; Control of Corrosiveness, Taste, and Odor; Primary and Secondary Treatment of Sewage; Sludge Treatment and Disposal; Industrial Water Supply and Waste Treatment; Arrangements for Construction; Design of a Modern Sewage-Treatment Plant; Design of a Water Treatment Plant; Appendix; Index.

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● PAVER equipped with the new Electromatic Screed Controller enables operator to lay a smooth mat automatically, regardless of irregularities in the road base.

Automatic Paver Control System

AN ALL-ELECTRIC depth-slope control system which enables paving crews to lay a uniformly even and smooth mat automatically, regardless of irregularities in the subgrade, has been developed by Iowa Manufacturing Company in conjunction with Minneapolis-Honeywell. The purpose of the Electromatic Screed Controller system is to assure accurate control of mat depth or thickness and to provide a precise slope angle for the crown of the road.

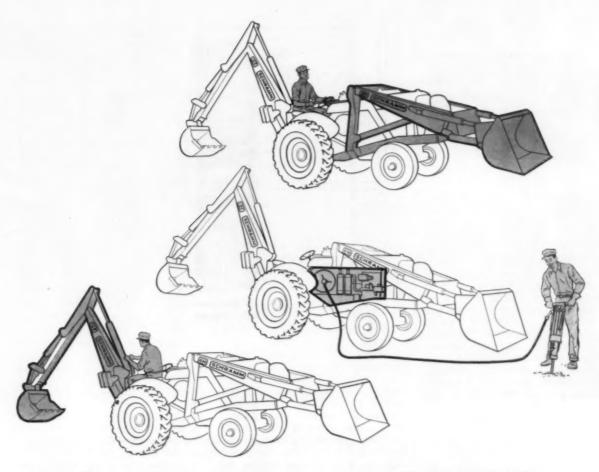
Development of the system was based on Minneapolis-Honeywell's experience in controlling tanks and guided missiles. Over 10 years ago Honeywell engineers devised precision controls to allow tanks to continue firing on targets while lurching over rough terrain at full speed. In working with Iowa Manufacturing to develop the Electromatic control system, which offers automatic two-axis control of grade and slope, refinements based on control systems for guided missiles and satellites were added. The re-"brain" sult was an all-electric which automatically controls the

Basically the screed control consists of six components; a command panel, pendulum, grade sensor, control box and a servo-motor located on each side of the paver. The command panel, sensor and pendulum feed electric signals based on de-

sired and existing grade and slope into the control box. Using this data, the control box electrically controls the servo-motors to vary the screed attack angle, automatically compensating for any road irregularities. A grid attached to the sensor rides on a taut spring accurately positioned to correspond to the desired surface level of the mat.

In addition to undergoing extensive tests on city streets and county highways, the Electromatic Controller has been rigorously checked out on a stretch of Interstate Highway 80. Highway Surfacers Inc., of New Hampton, Iowa, is using an Electromatic equipped Cedarapids Bituminous Paver to lay 400,000 tons of high-type asphaltic mix to a depth of over 20" on an 8-mile stretch of four-lane highway near Iowa City, Iowa. The paver is laying at a rate of 600 tons per hour. To keep up with this single unit, the contractor has 30 trucks hauling material from three bituminous mixing plants.

The paver controls are so sensitive that the screed reacts immediately if the sensor shoe passes over an object as thin as a dime. The system is so flexible that if the paver goes over a 4-inch railroad tie the only sign of the tie will be a 1/32-inch ridge in the first course, and the surface course will cover that.



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Prepared by L. G. BYRD, Associate Editor

New Base for Bid Price Index

For almost 30 years the Bureau of Public Roads highway construction bid price index has been a widely accepted and frequently used measure of trends in the cost of highway construction. The index, computed from information on some 30 major bid items taken from awards of contracts for Federalaid projects, has been published quarterly since 1933. Based on the 1925-29 period, it had been extended back as far as 1922.

Many changes have occurred in the nature of highway construction since the pattern for computing the index was first developed: quantities per mile differ radically; geographic distribution of work included in the base period was much different than it is now; and bituminous pavement was not directly included in the index.

In order to overcome such deficiencies, a new construction bid price index has now been devised, using 1957-59 as a base. Surfacing will now be represented by both portland cement concrete and bituminous concrete as indicators, and nationwide total quantities will be used in lieu of per-mile quantities for the base period.

The new index will be used exclusively beginning with the report for the first quarter of 1962 and, to provide transition in use, both the new and old indexes will be included in the reports for the third and fourth quarters of 1961. The design of the new index is explained in this article, and the historical trends from 1922 are shown on the new 1957-59 base.

"A New Base for the Highway Construction Bid Price Index Compiled by the Bureau of Public Roads. Reported by Edwin L. Stern, Head, Construction Costs and Price Trends Section. Construction and Mainenance Division, Bureau of Public Roads. Public Roads, October, 1961.

Wrong-Way Traffic Study

The 173-mile long Garden State Parkway has many toll-free sections precluding use of conventional ticket-type toll collection. Accordingly 11 toll barriers straddle the road in addition to nine ramp collection points. Two or three-lane directional roadways are separated by a center island of widths up to 600 ft. Shortly after a fatal accident resulting from a wrong-way vehicle collision with another vehicle, the Parkway police unit began to assemble data on wrong-way travel. The data gathered from May 1960 to May 1961 indicated it to be a serious problem. During the survey year, 278 wrong-way vehicles were reported, 123 of which were apprehended and interviewed. Witnesses to the wrong-way movement

furnished nine additional interviews bringing the record to 47 percent of reports. The interviews show that the wrong direction was accomplished by: 44 entering on exit ramps; 44 U-turns; 25 turned left (or right) at right (or left) en-trance; 14 exited on entrance ramps and: 5 other maneuvers. In the 4-year period from 1957-1960, only 19 accidents resulted from wrong-way travel. Three of these were fatal accidents and the wrongway driver was drunk in each of the three instances. Corrective action taken by Parkway engineers has included extensive directional signing at all points of possible confusion plus a concerted public information program to educate drivers.

"Wrong Direction Travel on New Jersey's Garden State Parkway." By Melvin J. Kohn, Traffic Engineer and Assistant, Operations Manager, Garden State Parkway, New Jersey. Traffic Engineering, September, 1961.

Porcelainized Steel Guard Rail

HIGHLY VISIBLE day or night, the nation's first stretch of porcelainized steel guard rail is being installed on a narrow bridge near Pleasant Corners, Pa. This highway guard rail combines the strength of steel with an attractive, highly reflective, maintenance-free coating of porcelain enamel. Protected by a ground coat and a white porcelain enamel cover coat similar to a kitchen range, this steel rail has a higher original cost than ordinary rail, but requires no paint and washes clean in the rain. The 12gauge guard rail was supplied by Bethlehem Steel Co. and the porcelain finish was applied by Erie Enameling Co., of Erie, Pa.





Michigan gets special boom... city gets low-cost pipe handling

With a unique boom fastened to its 1¼ yd bucket, a mobile Tractor Shovel is handling all pipe lifting and hauling chores for the City of Waterloo, Ontario, Canada.

Costs for this service have been cut substantially, and the need for an excavator crane has been eliminated.

The idea for the special boom was conceived by City Engineer, D. B. Dutton, shortly after the city acquired their Tractor Shovel—a 77 hp Model 75A Michigan! Handling of water and sewer pipe had always posed a problem . . . because it was an occasional job, the full-time crane was an unnecessary expense. However, noting the Michigan's exceptional stability and lift capacity (7,000 lbs), Mr. Dutton saw a way to cut costs both in the material yard and at the trenching site.

Long pipe no problem with Michigan stability

"We welded special brackets to the top of the Michigan's bucket to hold

a detachable 5 inch by 10 ft boom," reports Mr. Dutton. "Now, when there's a call for pipe, we simply drive the 26 mph Michigan over from one of its other jobs, attach the boom, lower the bucket, slip the boom into a pipe . . . and drive away. The machine loads both heavy 24" x 6' concrete and 14" x 13' transite pipe in the yard, and unloads at the site."

Assignments include landfill garbage disposal

This same stability helps the torque-converter-drive Michigan perform a wide variety of other digging and loading assignments for the 16,500 people of Waterloo. For example, the machine travels everywhere under its own power to backfill sewer excavations. It truckloads asphalt, gravel and dirt from stockpiles. It removes stumps and trees. Loads broken concrete. Delivers pre-cast catch basin sections. Clears snow from streets. Loads salt and gravel

into spreader trucks. And it handles work on the city's two land reclamation and sanitary landfill projects.

"The Michigan is the most economical machine we've ever operated," Mr. Dutton points out. "After 19 months of five and six day week operations, there has been no downtime or major repairs."

You can expect similar economies when you buy a Michigan . . . plus the added bonus of a large selection of money-saving attachments—street sweepers (with or without sprinklers); backhoes; crane hooks; fork lifts; scarifiers; "V", straight and blower type snow plows; tree transplanters; tampers; a wide variety of buckets. See your Michigan Distributor for a no-obligation demonstration.

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Dynamic Weighing of Vehicles

A dependable method of weighing the axle loads of a moving vehicle is needed in the collection of highway planning data and as an aid to the enforcement of load limit regulations. A research project now under way at the University of Kentucky has as its objective the development of such a method. The first phase of the project included an appraisal of field of dynamic weighing. This article reviews the development of the dynamic electronic scale and the experiences of a number of state highway departments with its practical use. Recent experimental developments in this country and Europe are described and evaluated. Some conclusions are reached and the future course of the Kentucky project is outlined.

"Dynamic Weighing of Vehicles."
By John A. Dearinger, Assistant
Professor of Civil Engineering, College of Engineering, University of
Kentucky. Public Roads, October,

Highway District Maintenance

The maintenance program in District VII of the California Division of Highways is steadily shifting its emphasis from routine maintenance of conventional highways to the more specialized maintenance of controlled-access, fully-landscaped freeways. With the District headquarters in Los Angeles, several maintenance programs must be carried out only on Sunday mornings before church time on heavily traveled freeways such as the Hollywood and Harbor Freeways. The change in maintenance emphasis is indicated by the increase in cost of repairs to appurtenances (guard rail, signs, light standards, etc.) which rose from \$155 thousand in the 1955-56 fiscal year to \$255 thousand in the 1959-60 fiscal year. Signal and lighting costs also showed an increase, rising 12% last year. The District conducts an annual oiling program employing emulsion slurry seals, sand seals, flush seals using SC-2, and heaterplaner and patching work. Under formal contracts, state highways within city boundaries are maintained by state forces on a reimbursable basis. The District has 568 units of equipment: 33 for signals and lighting; 81 for landscaping; 34 for signs and striping; and 420 for standard operations. Twenty addi-



Seal Coating with Cationic Bitumuls produced uniformly fine results in spite of early showers

CATIONIC BITUMULS SPEEDS SEAL COATING IN TACOMA

The City of Tacoma, Washington, has two major sources of street maintenance problems. First, some forty miles of very old (1890-1915) sheet asphalt surfaces. These are now badly cracked and extensively patched. Second, several hundred miles of streets that have only a light bituminous treatment. The ever-increasing traffic load is starting to cause trouble on these.

In the past, the City has settled for continuous patching on the sheet asphalt; and Seal Coating of the light bituminous arterials, using either anionic emulsions or cutbacks. The Seal Coating required closing the streets to traffic for long periods; and weather was a constant threat, restricting the work seasonally.

City maintenance forces were quick to see two major advantages of Cationic Bitumuls when it was first introduced. A-This material

had a natural affinity for the cover aggregate being used. B-The rapid-setting characteristics sharply reduced the danger of "wash-off" from rain. (When showers actually occurred within two hours of job completion, there was no damage!)

Based on earlier work the City was able to "field" a well-integrated Seal Coating team. Cationic Bitumuls sets rapidly so that Seal Coating operations were co-ordinated even more closely. Both the cover-stone truck and the pneumatic roller could follow very closely behind the distributor!

The Seal Coating operation has now been extended to the "ancient" sheet asphalt pave-

ments. Here it prevents the breakup action that made earlier patching necessary.

Using Cationic Bitumuls, streets are closed to traffic a much shorter time; and the work season begins much earlier in the year.

Discover for yourself the ability of Cationic Bitumuls to extend the work season; and to coat and hold most aggregates—even those normally regarded as "difficult". Bitumuls Engineers in our nearest office will supply full information; and will arrange for you to see a Cationic Bitumuls job in your area.



Close-up view of a Cationic Bitumuls Seal Coat. Note uniform cover-stone retention



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tional units will be required in the next fiscal year for landscape work and 16 to equip a new maintenance station.

"Maintenance in VII." By W. D. Sedgwick, Assistant District Engineer, California Division of Highways. California Highways and Public Works, July-August, 1961.

Fly Ash for Cement

This article reports a study of the use of fly ash as a replacement for part of the cement in concrete mixes prepared with portland cement and portland blast-furnace slag cement, and tests of a recommended adjusted mix containing fly ash. The results show that fly ash can be used satisfactorily as a replacement for portland or slag cement, but the properties of the concrete are affected by the carbon content of the fly ash. It is indicated that the amount of fly ash used should be correlated with the amount of lime released by the portland cement.

"Concrete Containing Fly Ash as a Replacement for Portland Blast-Furnace Slag Cement." Reported by William E. Grieb and Donald O. Woolf, Highway Research Engineers, Division of Physical Research, Bureau of Public Roads. Public Roads, October, 1961.

Financing City Street Program

*Optional

With its incorporated area having doubled in the last decade. Columbus, Ohio, has many financial and engineering problems in its street program. Street mileage is separated into classifications: Interstate routes, major thoroughfares on state routes, major thoroughfares off state routes, secondary thoroughfares on state routes, secondary thoroughfares off state routes, residential streets and alleys. Construction is based on a 5-year capital improvement program; maintenance operates on a 2-year program. The city has an area of 91.2 square miles with 1,002 miles of paved streets, 300 miles of paved alleys and 13 centerline miles of expressway. Construction contracted for in 1960 included \$430 thousand on city streets, \$1.2 million on state routes and \$2.5 million on Interstate expressways-all within the city. Maintenance expenditures \$2.8 million. Revenue from gas tax and vehicle license fees amounted to \$3 million. Thus income barely exceeded maintenance expenses and other funds were obtained from



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public-voted and Council-voted bond issues. During the last 10 years, the city population increased 34 percent, motor vehicle registration 70 percent and trip mileage increased 123 percent. While city participation in Interstate highway construction is only 5 percent, city expense in maintaining these facilities within the corporation limits is 100 percent. This major financing problem must be solved if obligations are to be met.

"Financing and Engineering Problems of Street Construction and Maintenance." By Ernest H. Stork, Director of Public Service, Columbus, Ohio. Ohio Cities and Villages,

September, 1961.

Interstate **Highway City**

Flanking both sides of Interstate Route 71 for two miles in northcentral Ohio, a \$75 million interregional travelers' center and motorists' city will include motels, service stations, restaurants, shopping facilities, golf courses, etc. The area is not on the Interstate system right-of-way, which is prohibited by law, but it will be easily reached by an existing interchange and access roads. Midway is a road bridging the Interstate freeway to cross over from one part of "Twin Parks" to the other. Twenty four pieces of property were bought up by the developers to make up the huge tract required for the project. Believed to be the first of its kind in the United States, it could be the forerunner of other motor parks along the 41,000-mile controlledaccess Interstate system.

Highway Highlights, August-September, 1961.

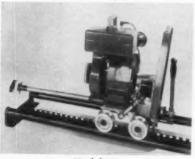
Other Articles

"Timely Maintenance-A Vital Highway Need." How a sound roadway maintenance program may be established by an evaluation of needs based on AASHO road test. By Bertram D. Tallamy, Consulting Engineer, Washington, D. C. Public Works, October,

"Survey Shows State-Owned Equipment." Major maintenance and construction equipment ownership listed for thirty states. Public Works, October, 1961.

"Minnesota's State-Aid Program-Made Effective by Teamwork Between State and Local Agencies." Forty years of experience with a state-aid highway program in Minnesota has emphasized the importance of cooperation in intergovernmental relationships. By J. M. Evans, State-Aid Engineer, Minnesota Dept. of Highways, St. Paul, Minn., and Archie N. Carter, F. ASCE, Presi-

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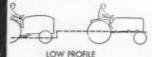
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*SHUTTLE Clutch available on the D-15 and the new H-3 and HD-3 compact crawlers!

dent Carter, Krueger & Assoc., Inc., Minneapolis, Minn. Civil Engrg., Sept., 1961.

"Chemical Approach to the Roadside Grass Maintenance Problem." Use of chemical growth inhibitor has effectively reduced costs and increased safety of Connecticut's roadside maintenance program. By William C. Greene; Landscape Engineer, Connecticut State Highway Department. Public Works, October, 1961.

"Plan for a County's Needs." Balanced growth on a long-term basis through comprehensive, planned, integrated county and urban development programs. By Don B. Salyer, Planning Director, City Planning Commission, Cedar Rapids, Iowa. Better Roads, September, 1961.

"Planning a Successful Leaf Removal Program." Intensive village-wide collection program removes 1 cu. yd. of leaves per capita, thus reducing a fire hazard and nuisance. By M. J. Seeley, Village Engineer, Ridgewood, New Jersey. Public Works, October, 1961.

"Rock Salt Stabilization Winter-Proofs Roads. Construction details and results of rock salt stabilization. By Stanley S. Scarborough, Projects and Materials Engineer, Delaware State Highway Dept., Public Works, Oct., 1961.

"A Report on Hydrated Lime for Use in Experimental Hot-Mix Asphaltic Concrete." By Richard C. Crandall, Senior Laboratory Engineer, and Fred L. Finke, Chief Laboratory Assistant. Texas Highways, September, 1961.

"Traffic Controller Avoids the "Wasted Green Light." New electronic device uses vehicle demand exclusively to control signals at intersections. Public Works, October, 1961.

"On-The-Job Action Keeps Borough Streets Open." Good planning and effective use of equipment provide open streets all winter. By Frank Force, Manager-Engineer, Hellertown, Pennsylvania. Public Works, Oct., 1961.

"New Laboratory for Basic Research in Soil Mechanics and Foundation Engineering Is Completed." One of the few laboratories in the United States that will be devoted entirely to basic research in the field of soil mechanics and foundation engineering has recently been completed in the Civil Engineering Building of the A. & M. College of Texas. The laboratory was made possible by a grant from the National Science Foundation. By Wayne A. Dunlap. Texas Engineering Experiment Station News, September, 1961.

"Safety Rest Areas on Wisconsin's Interstate System." Early observations indicate a high degree of usage that will justify the comprehensive facilities provided. By C. E. Aten, Engineer of Maintenance, State Highway Commission of Wisconsin. Public Works, October, 1961.

"Thruway Prepares for Winter Storms." Provisions for the safety of motorists on the New York Thruway. By Robert Dyment, Technical Writer. Public Works, October, 1961.

PUBLIC WORKS for November, 1961



ROADWAY design information and statistics produced by Arizona Highway Dep't. computer are reviewed by Messrs. Gregg and Stanton.



 SECTION of Interstate Highway in Arizona designed with aid of 90-column card computer described in text.

Applications Of Computers In Public Works Engineering

JOHN W. SULLIVAN

National Manager, Education, Industry, Marketing, Remington Rand Univac Division, Sperry Rand Corporation

Dollar Savings which can be counted as high as \$600,000 annually; the ability to choose between eight different engineering designs for new street construction—these are only two of the realities made possible through use of the electronic computer in public works engineering and accounting.

The computer has already become an important tool in this field for two major reasons: One, the need for our expanding cities and counties to provide more public works for less money; and second, the high cost of qualified engineers who also are extremely difficult to find. For these reasons alone, the computer has found acceptance in public works administration.

Now the trend is to combine utilization of this new tool in the mathematical or engineering phase with what might be called public accounting. For example, it has been found that the closing of a survey traverse can be performed in a Univac Service Center for 10 cents a line, a line being one line of a piece of property. For a rectangle,

the cost would be 40 cents. Compare this to the cost involved when a competent civil engineer must work for 30 to 45 minutes on a desk calculator to do the same thing.

In a study of a California locality, it was found that a 10-man department expended nine man-days a month to prepare the reports needed by various governmental agencies on the work of the department. A computer was able to do the job in half a man-day. Perhaps of even greater importance is the fact that the reports were out the day following tabulation of the information, not three weeks later, which was often the case when done manually.

Many smaller localities tend to think of computers in terms of high costs. They still believe the only way a computer can be used is by renting or buying one and they feel that either is too expensive. The fact is, however, that there is no need either to rent or buy. At Univac Service Centers, staffed by trained technicians, the client pays only according to the work actually done for him on the computer and its allied machines. In this manner cost often becomes an infinitesimal item, especially when measured against the result obtained.

Consider the case of one county which used a Univac Service Center. This county was able to relate computer use directly to their capital improvement program in this manner: Studies showed that if construction jobs could be let within a certain three-month period every year, cost savings of between 10 and 12 percent could be realized because during that time of the year construction in the locality slowed down and contractors bid lower.

In order to do this, the construction plans had to be completed on a specific time schedule. If these plans were to be developed manually, according to conventional methods, it would be impossible to get them ready on time. Using the service center, the time schedule was met and the resultant savings realized. Although this is not a large county, the capital improvement program involves the expenditure of some \$6 million a year. Applied to the total, a ten percent saving would amount to \$600,000 per year.

In the case of another locality—again by no means a large unit—computer use enables engineers to develop eight alternate engineering designs for each street to be reconstructed or widened. These eight different designs cost no more than the two designs normally developed previously by hand.

It becomes obvious, of course, that public works officials choosing between eight designs will be able



Municipal maintenance costs go down when you

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Air power is an important cost for most municipal construction and maintenance work. Keep it *low* by depending on Ingersoll-Rand Gyro-Flo portable compressors for long-range savings in fuel, lube oil and up-keep costs. Their design is the result of 10 years of experience by the pioneer builder of portable rotary compressors.

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to do a better job, from every point of view, than if their choice is limited to two designs. The exact cost differential between computer and traditional methods is secondary, when benefits in improved engineering and administration made possible by the availability of additional data are considered.

An important point right now concerns the 1960 Federal Census. The results of this are being felt on all levels of government, particularly those related to public works and traffic administration. This census data must be used in such work as Interstate highway projects, urban renewal programs and health and sanitation control in which the Federal government is involved. The local administrator must handle and digest this mass of information, relating it to his own needs while meeting Federal requirements. He must act quickly, while the data are still fresh and have real meaning.

In every public works program there are many needs and many facts. It is far more expensive than ever before to sift through and arrange data properly. Often there is not time to wait several months for such studies to be completed. It is often essential that an intelligent decision be made promptly by responsible officials. In meeting this need the computer makes what is probably its most important contribution.

Long Shot

The longest electronic distance measurement ever made has been reported by the Arizona Highway Department. Using a Tellurometer System, the highway engineers report a measurement of 139 miles.

Carl C. Winikka, controls engineer for the department, in a report to the U. S. Bureau of Public Roads, said a departmental survey party made the "shot" from two high points across flat land. Each end was near a U. S. Coast and Geodetic Survey triangulation station, and it was possible to determine that the measurement was accurate to within 12 feet in that distance, or 1:60,000, which is well within the accuracy required for highway surveying.

The Tellurometer System is composed of two units—one at each end of the line to be measured. Highspeed micro-waves transmitted from one to the other are recorded in billionths of seconds travel time, then quickly converted into miles, feet and inches.

What to tell your board about LW motor graders for snow plowing

If you hire extra help to handle your emergency snow plowing, choose firms with LW's. This big "660" grader . . . handling a 10-inch snowfall with its moldboard and wing attachment . . . belongs to Bigras Excavations, Inc., who contracted with city of St. Martin, Quebec, to clear 25 miles of street. Says owner Ivan Bigras: "It has all the power necessary to get the work done — whether it's snow plowing, rough or finish grading, or mixing."

If the board or commission to whom you report wants to know WHY you want to handle snow removal with LeTourneau-Westinghouse motor graders, you can give them a convincing explanation.

you can assure them LW's will do the job...because all seven sizes (85 to 190 hp) give you power and traction not possible with the average truck-mounted plow. And, you need your trucks to spread salt and cinders, anyway. With an LW, you get up to 16 tons of weight behind your plow, plus transmissions that gear WAY down... to as low as 0.22 mph! You won't have to apologize for this equipment when big snows hit!

with an LW, you buy versatility. Use it with a big (11' or 12'2") V-type plow...and/or a 12' wing, that angles from horizontal to 90°...and a Snow-Blo, that attaches to the wing to blow snow clear of the road. Of course, you can always move a lot of snow with the grader moldboard alone.



months, you'll use these units all year long, on all your grading jobs. You're buying quality, too. Welded, one-piece frame, for longer life, lower upkeep costs. More operator conveniences. More brake power. Higher speeds, for more work done per shift.

you're interested in saving money. Feature for feature, horsepower for horsepower, LW graders cost LESS than any other make.

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Prepared by ALVIN R. JACOBSON, Ph.D.

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

BOD Studies

This paper is the third in a series reporting results in an investigation of the biochemical degradation of organic compounds. As part of this research program, bench-scale completely-mixed bio-oxidation units were operated continuously for more than 18 months. The study was initiated on the postulation that there is no essential difference in the progression of bacteria growth over the broad range of environments encountered in industrial waste treatment and water pollution control. This paper presents theoretical and experimental evidence, supported by mathematical and biochemical formulations of the interrelationship of the areas of pollution measurement, waste "strength," biological treatment, and receiving water self-purification. The first step in the study was a statistical analysis of the short-term BOD test values for the two primary 5-day standards. The second step of the study was a delineation of the mode of solids synthesis in biological oxidation of glucose in exerting 41.1 percent of the theoretical oxygen demand. From these studies it is indicated that there is a correlation of oxygen utilization, in the short-term BOD progression, and bio-oxidation solids production, as a function of solids age. Substantiation of predicted solids production from the BOD test through the Warburg and oxygen utilometer to bench-scale completely-mixed systems is also demonstrated, using the results of other investigators where applicable. It appears that the shortterm BOD test offers a mode of determination of ultimate BOD, maximum solids production, and maximum rate of oxygen uptake.

"Aerobic Bacterial Degradation of Glucose." By A. W. Basch, Asst. Prof. of Civil Eng., Rice University, Houston, Texas and N. Myrick who was Research Associate at the same institution. He now is in the Department of Civil Engineering at Washington University, St. Louis, Mo. *Journal WPFC*, September, 1961.

Don't Abandon That Old Incinerator!

In recent years many municipalities have had to redesign their incinerator plants because of the great change that has taken place in the composition of refuse. Formerly incinerators were designed with special hearths or other provisions for drying the refuse because the municipal refuse contained 50% or more of garbage and was wet, heavy and compact. Preheaters, auxiliary burners, and other devices were provided in the constant struggle to maintain the temperatures required for satisfac-

tory, odor-free combustion. Today drying hearths and preheaters are no longer required; the problem is one of holding temperatures down because the municipal refuse is light and bulky, frequently containing 85 to 90 percent or more combustible rubbish, and 10 to 15 percent or less garbage. For satisfactory operation, today's incinerator plant must be capable of handling a greater volume per ton of refuse as received and as charged to the furnaces: higher combustion temperatures; and greater volumes of gases of combustion and combustion air. Unquestionably, the most frequent modification of incinerators in recent years has been the replacement of fixed manually stoked grates with modern mechanical grates resulting in an increase in burning capacity with a substantial reduction in manual stoking. Refuse storage is another problem in many present-day incinerators.

Sewerage and Sewage Treatment for Hemphill

BECAUSE of growing population and industry, including a large poultry raising project, Hemphill, Tex., engaged F. B. Woodruff, consulting engineer of Fort Worth, to prepare plans and specifications for a sewer system and treatment plant. Elrod Construction Co. of Linden was the contractor for the sewer lines. The more than 11 miles of pipe installed was made by W. S. Dickey Clay Mfg. Co., using the Dickey coupling which provides a flexible, compression - type joint. Totals included 14,220 ft. of 8-in., 20,920 ft. of 6-in. an 22,515 ft. of 4-in. A check following completion of the work showed infiltration too small to be measured. Graham Construction Co. of Cameron was contractor for the treatment plant. Dr. D. G. Mann is mayor of Hemphill.



• GENTLE push by a workman joins Dickey Coupling/Pipe for tight seal.

Atlanta's Planned Future

WITH P.F.T.

Atlantans have their eyes on the future. They are not content with their tremendous industrial growth which has averaged 83 new industries per year for the past 12 years and being the first city in the deep South reaching one million population. They are looking forward to an expanding growth. Atlanta is expanding and modernizing their sewage treatment plants to meet future needs.

The South River plant, one of Atlanta's largest, was built in 1936. Sewage treatment equipment by P.F.T. was selected for this plant and has been an integral planned part of every expansion.

WIEDEMAN AND SINGLETON, CONSULTING ENGINEERS of Atlanta designed each of the three additions to the South River plant. P.F.T. equipment at this plant is as follows—

1936—2 P.F.T. 55' Floating Covers, 4 P.F.T. 173' Rotary Distributors. 1953—Added 1 P.F.T. 55' Floating Cover, 2 P.F.T. #500 Heater and Heat Exchanger Units with P.F.T. Gas Safety Equipment. 1959—Added 2 new P.F.T. high capacity Rotary Distributors on 150' Filter Beds. 1960—Added 2 P.F.T. 100' Floating Covers, 2 P.F.T.—Pearth Gas Recirculation Systems, 2 P.F.T. #1000 Heaters and Heat Exchanger Units, Supernatant Selectors, Gauge Boards and Gas Safety Equipment.

This is the first of Atlanta's four sewage treatment plants to be enlarged in the comprehensive plans to prepare for the future. You'll be hearing more about P.F.T. in Atlanta's far-sighted program.





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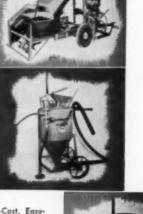
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The portable Model G-6 Grouter and CP-10 Placer is ideal for soil stabilization, tunnel backfilling, filling hard to get to forms, etc. Both the G-6 and CP-10 have capacities of up to 5 cu. yds. or more depending on materials used and job conditions.

AIRPLACO JET-BLASTERS For Low-Cost, Easy-to-Use Sandblasting (wet or dry). The Model B-6 single charge (650-lb. capacity) and B-3C continuous feed (500-lb. capacity) Jet-Blasters are designed to handle all abrasive materials for cleaning, polishing or etching of any type of surface. Jet-Blasters are available with accessories for wet or dry blasting and new exclusive "Sand-Saver" remote cut-off valve.

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The most economical solution is construction of a refuse storage pit of adequate size, usually with a crane and bucket to transfer refuse from pit to charging hoppers. The authors have cited three examples to illustrate the varying extent of alterations or reconstruction required to modernize different incinerator plants.

"Don't Abandon That Old Incinerator—Yet." By Glen H. Abplanalp, Partner, and Junius W. Stephenson, Project Engineer, Havens and Emerson, Consulting Engineers, New York, N.Y. Public Works, October,

1961.

Combined Sewers and Pollution

Combined sewers have often been implicated in the perpetuation of pollution of receiving waters despite the construction of sewage treatment works. Overflows from combined sewers often grossly pollute waters which may have satisfactory dissolved oxygen and bacteriological characteristics during extended periods of dry weather flow. Several examples were cited by the authors regarding the effects of combined overflows in the United States and Canada. It was noted that over 1400 municipalities employ combined sewers serving a total population of approximately 50 million persons. Several cities in these countries use stormwater tanks to hold part of the stormwater flow. British cities have been employing stormwater treatment tanks for many years. Their engineering profession usually employs the combined sewer design recommendations of the Royal Commission on Sewage Disposal which are as follows: 1). The level of sewer overflow weirs is generally designed to retain up to 6 times DWF (dry weather flow) whereas American overflow weirs are generally designed to discharge at 2 or 3 times average DWF. 2). Flows up to 3 DWF are given full treatment at the regular municipal sewage treatment plant. 3). Flows between 3 and 6 DWF are given partial treatment in stormwater tanks. 4). Excess above 6 times average DWF is discharged to a receiving stream without treatment. 5). Overflows on branch sewers should be used sparingly. 6). Screens (6-in. and 1-in. openings) and constant velocity grit chambers generally precede the stormwater tanks to reduce the tank cleaning problem. Unlike the U.S., Great Britain does not employ bacterial standards for its natural wat-



For strength economy, durability

Topeka selects Armco SMOOTH-FLO Pipe for strength, top flow capacity



When Topeka, Kansas, required an 8200-foot sanitary sewer in high water table conditions, engineers sought a pipe that would be strong enough to withstand heavy loading and still move fluids efficiently. After considering several kinds, corrosion-resistant Armco Asbestos-Bonded Smooth-Flo® Sewer Pipe was selected.

Corrugated for strength and durability, but covered inside with a smooth lining for high flow capacity, 36-inch SMOOTH-FLO Pipe was placed in a 25-foot average-depth cut. As the picture shows, sheeting was used for shoring and jacks were installed between the 20-foot-long I-beam wales. As the cut was made, the sheeting was moved back and SMOOTH-FLO Pipe was lowered into place.

Find out how Armco ASBESTOS-BONDED SMOOTH-FLO Pipe can help solve your sanitary sewer problems. Write to Armco Drainage & Metal Products, Inc., subsidiary of Armco Steel Corporation, 6991 Curtis Street, Middletown, Ohio.



ARMCO Drainage & Metal Products

ers and disinfection with chlorine is not considered to be a worthwhile project. Removal of suspended solids by sedimentation in stormwater treatment tanks increases the effectiveness of chlorine disinfection; in fact, it is a necessity. Stormwater runoff having a high BOD certainly may have a significant effect upon the dissolved oxygen in streams whereas the runoff may account for only an insignificant increase in the coliform density of the combined sewage. The authors believe additional information is essential to a thorough understanding and approach to this problem.

"The Influence of Combined Sewers on Pollution Control." By Harold Romer, Director, Bureau of Sanitary Engineering, New York City Department of Health, and Lester M. Klashman, Regional Program Director, Water Supply and Pollution Control, Regions 1 and 2, Public Health Service, U.S. Dept. of Health, Education and Welfare. Public Works, October, 1961.

Oxidation Pond Loading Rates

Results of studies carried out at the University of Florida on an ex-

perimental stabilization pond during the winter of 1957 showed that organic lagoon loadings of 225 lb. BOD/acre/day produced a stabilized effluent and did not cause any objectionable odor or appearance. As a result of this earlier work a further investigation was undertaken to verify these findings by studying similar organic loadings during other seasons of the year and also to evaluate the effect of pond depth on operating efficiency. Four separate experiments, each approximately two weeks in duration, were employed as follows: 1) Organic loading rate 200 lb. BOD/acre/day, depth 2.5 ft; 2) Organic loading rate 300 lb. BOD/acre/day, depth 2.5 ft; 3) Organic loading rate 200 lb. BOD/acre/day, depth 3.5 ft; and 4) Organic loading rate 300 lb. BOD/acre/day, depth 3.5 ft. The results of these investigations indicate the feasibility of organic loadings of 200 lb. BOD/acre/day for stabilization ponds in climates similar to that of north-central Florida. They also indicate a possible need for surface effluent withdrawal to prevent scum formation due to algae which might interfere with the aerobic stabilization process. It was found that pond depth (2.5 to 3.5 ft) had no effect on operating efficiency, that reduction of BOD, coliform bacteria, and nitrite and nitrate production remained constant while the operating depth was varied between these depths.

"Depth and Loading Rates of Oxidation Ponds." By Donald A. Mills, Engineering Department, Hercules Powder Co., Wilmington, Delaware. Water & Sewage Works, September, 1961.

Chlorination of Wastewater

Accomplishment of sewage disinfection by chlorination is variable under plant conditions of operation. The usual procedure measures accomplishment by either of the following parameters: a) analysis for coliform bacteria in the effluent determine compliance standards set by regulatory agencies, and b) chlorine residual. The type of sewage treatment chlorine dosage and contact time are factors that must be considered in effluent disinfection. The authors examined coliform data from eight waste treatment plants in regard to accomplishment of disinfection by chlorination. Accomplishment was governed by compliance with two coliform standards of 20 and 100



Rapid growth during the past ten years resulted in North Canton, Ohio becoming a City in 1961. Even faster growth is anticipated through annexations, and the City officials have wisely taken this into account by long range planning.

A major problem created by the rapid expansion is the ability to provide adequate sewer cleaning service for today's needs, plus reserve capacity for the future. After careful investigation, Water & Sewer Supt. A. J. Haun found that by purchasing and truck-mounting a SeweRoder, a single rodding crew could easily maintain the entire system on a preventive maintenance basis. He says, "we find the Sewerroder to be the easiest machine to set up and operate that we have ever had."

The SEWERODER's superior performance is made possible by many unique and exclusive features, such as positive non-slip rod drive, automatic safety clutch, instantly reversible push-pull power. All rods are self-contained in the machine and operating controls are conveniently located. Set-ups are made from street surface by merely

lowering the hose guide into the manhole by means of a rope.

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for outlying areas without municipal sewerage facilities — for subdivisions, apartments, industrial communities, military bases, schools, shopping centers, resorts, hospitals, motels and mobile home courts.

Factory-built "Oxigests" are available in a variety of standard sizes, can be installed in less than a day after delivery to the job site on special-made trucks. "Oxigest" units can be installed in parallel, to provide

"Oxigest" units can be installed in parallel, to provide greater capacity for expanding subdivisions or other developments.

Field-erected "Oxigest" units are available for small communities, growing subdivisions and other, larger applications. They are factory-fabricated for erection in the field on the owner's foundation with all equipment installed.

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For outlying military bases, such as this one, a dual "Oxigest" with 47,500 gallons per day capacity provides the answer to sewage treatment problems.



The offshore Freeport Sulphur Mine is an unusual example of a remote community served by an "Oxigest" unit.



A Kansas City North subdivision is a good example of installations in parallel to serve a growing development.



Glen Oaks School in Baton Rouge, La., is a typical "Oxigest" installation to serve a school without sewers.



Camden, N. J., Latin Casino theatre and restaurant is provided sewage treatment by a large bolt-together "Oxigest."



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A St. Joseph, Ma., mobile home park is served by a Smith & Loveless "Oxigest," with the new Alcoa aluminum fencing.



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Rugged Sutorbilt rotary positive-pressure blowers reduce maintenance, cut replacement costs, and assure a high level of performance. They deliver 800 to 23,000 cfm at pressures from 2 to 12 psig. Available with timing gear diameters from 10" through 26" in horizontal designs. Many sizes also offered in vertical case arrangements. Ideal for aeration of grit chambers, channel aeration, pre-aeration flotation, flocculation, tank aeration, air lifts, gas recirculation.

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per 100 ml. Compliance was found to be independent of chlorine residual, and both coliform standards were met in the absence of chlorine and under conditions of chlorine residuals ranging from 0.1 to 5.0 mg/L. Percent compliance with either coliform standard could not be predicted, therefore, on the basis of a specific chlorine residual. To assure adequate control and accomplishment, coliform bacteria, as well as chlorine residual, must be determined. Higher percent compliances were observed with contact periods of 30 and 33 minutes than with contact times of 3, 10, and 20 minutes.

"Compatibility of Wastewater Disinfection By Chlorination." By H. Heukelekian, Chairman Dept. of Sanitation and S. D. Faust, Associate Professor, both of the New Jersey Agricultural Experiment Station, Rutgers University, New Brunswick, N.J. Journal WPCF. September, 1961.

Other Articles

"Man In Space—He Takes Along His Wastes Problem!" Algal-bacterial system can convert man's wastes to oxygen, water and food for extended life in orbit. By William J. Oswald, Associate Professor of Sanitary Engineering and Public Health and Clarence G. Galueke, Associate Research Biologist, University of California, Berkeley. Wastes Engineering, September, 1961.

"Sludge Reaeration in the Activated Sludge Process-A Survey." A discussion of data obtained from a number of sewage treatment plants. By T. R. Haseltine, Partner, The Chester Engineers, Pittsburgh, Pa. Journal WPCF, September, 1961.

"Water Pollution Control Based on Facts." Condensed from a paper presented before the Symposium on Water Quality Measurement and Instrumentation, August, 1960, sponsored by the Public Health Service, Cincinnati, Ohio. By Thomas R. Glenn, Jr., Director and Chief Engineer, Interstate Sanitation Commission. Public Works, October, 1961

"Are Domestic Sewage Lagoons Safe?" A leading antagonist in the controversy over lagoons versus mechanical sewage treatment facilities offers this rebuttal against arguments for sewage lagoons appearing in Reader's Digest for July, 1960 entitled "Nature's Wondrous Way with Waste" by Don Romero, Ass't. Prof. of Journalism, University of Missouri. By H. O. Halvorson, Director, School of Life Sciences, University of Illinois. Public Works, October, 1961.

"Keeping a Sanitary Landfill Sanitary. Unfortunately, too many communities have adopted only the name —"sanitary landfill"—not the method. By Bayard F. Bjornson, Training Branch, and Malen D. Bogue, Technology Branch, Communicable Disease Center, Public Health Service, Atlanta, Georgia. Public Works, September, 1961.

Economical Survey Method for Sewer Design.." Planimetric mapping had several advantages over ground survey methods for expanding sewerage facilities at San Diego. By Leighton S. Hammond, Chief of Surveys, Holmes & Narver, Inc., Los Angeles, Calif, Public Works, September, 1961.

"Processing Liquid Radioactive Wastes at Argonne." By Gladys Swope, Argonne National Laboratory. Journal WPCF, August, 1961.

Systematic Maintenance

(Continued from page 132)

correct a minor difficulty before actual trouble or failure results. The mechanic should be encouraged to investigate driver reports as thoroughly as possible and keep his eyes open for additional defects in the equipment to which he is assigned.

The unifying element in a successful preventive maintenance program is the record of maintenance performed on each vehicle. Records are essential if the value of preventive maintenance is to be spelled out in terms of longer vehicle availability at lowest per-mile cost. Maintenance record forms can be obtained from most automotive equipment manufacturers and many major oil companies. The marketing affiliate of the author's company, for example, provides freeof-charge a set of simple Trouble-Free Maintenance records* which include comprehensive lubrication charts for the specific vehicle makes and models in a given fleet.

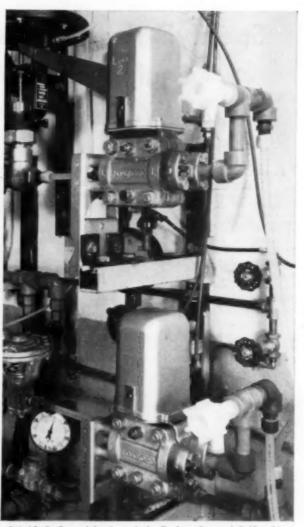
The essential single record which all others are designed to develop is the one which will show the exact cost per mile of each vehicle. That figure is obtained by adding together: 1) Original cost of equipment, less credit for resale or tradein; 2) cost of fuel and lubricants, plus labor; and 3) cost of replacement parts plus labor (including costs incidental to failure of equipment on the road) and dividing this sum by the total number of miles traveled.

With regularly scheduled preventive maintenance, the resulting figure will reflect the lowest cost per mile and highest possible rate of vehicle availability.

*Available from Gulf Oil Corporation, Consumer Marketing Division, Gulf Building, Houston 2, Texas.



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Problem of metering liquid alum solved with the Foxboro Integral Orifice d/p Cell* Transmitter

Unique system helps Salem and Beverly Water Board save \$2000 per year in water treatment costs

The Salem and Beverly (Massachusetts) Water Supply Board had a problem. They wanted the economy of liquid alum as a coagulant for water treatment. However, conventional metering devices tended to "coat" or bind when exposed to alum-andwater solution. Continued, accurate measurement was impossible.

Installation of Foxboro Integral Orifice d/p Cells proved the perfect answer. Since this unique transmitter can meter flows as

tiny as .003 gpm, it permits ratioing alum syrup direct to raw water — without the problems of dilution. What's more, its wide rangeability permits using the same transmitter for both summer and winter alum feed requirements.

In over 2 years of operation, Salem and Beverly report, "there has been no evidence of plugging of our Integral Orifice d/p Cells — measurement has been stable."

Providing stable measurement of liquid alum is just one of the ways Foxboro control can improve your operating efficiency.

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Specifying and Purchasing Equipment for Sewage Works Construction

C. D. MULLINEX
Partner, Howard R. Green Company,
Consulting Engineers,
Cedar Rapids, Iowa

THE TREATMENT of sewage and industrial wastes has become an increasingly mechanized process during the past 30 to 35 years. Since the days of Cameron tanks, Imhoff tanks and sand filters, when the automatic siphon was the only piece of mechanical equipment used, many new treatment processes and associated accessories have been developed involving mechanical equipment. During the period of nonmechanization, designing engineers avoided mechanical equipment whenever possible. In Iowa, there were instances where as many as three or four sewage treatment plants were built to avoid the construction of lift stations. By contrast, another Iowa project currently under construction will ultimately require 40 lift stations to serve a sanitary district with one sewage treatment plant.

In many cases, the effectiveness of the treatment process is directly related to the functional dependability of the equipment used. In other words, the success or failure of the treatment system as designed and planned is directly related to the equipment selected. This applies not only to processing equipment (equipment designed for a specific step in treatment procedure) but also to accessory equipment included to facilitate the operation of a treatment process.

Specifying and purchasing equipment for sewage works, therefore, becomes a very important part of sewage treatment planning. As designing engineers, we are dependent upon the performance of such equipment to demonstrate to our clients that we have successfully solved their sewage treatment problems. Therefore, it is imperative that the system used by the engineer to select the required equipment, must be such that it will permit him to consider the functional features and reliability required to meet treatment demands and minimize

maintenance, repair and operation expenses for the client.

In 1928 our firm developed a socalled fixed sum system for the selection and purchase of mechanical equipment. This system has been used not only in connection with sewage works, but also for other projects where we felt it was desirable for the client to have direct control over the selection and purchase of equipment and certain items of material. The engineer includes in his construction specifications fixed sums for each item of equipment. In bidding on the project, the contractor includes these sums in his estimate without considering the type, make, or cost of the equipment finally selected. This procedure gives control of the purchase of equipment and permits recognition of factors of design and guaranteed efficiency, as well as the record of the manufacturer. It systematizes the receiving of bids so that the general contract can be awarded immediately, and the contractor can start work fully protected as to price of mechanical equipment. It gives time, following the receiving of proposals, to tabulate the characteristics and prices of various items of mechanical equipment offered and to make our selection at a later date than that of the award of the general contract. It is fair to all parties concerned. It does away with the possibility of a favored price to a favored contractor by a manufacturer.

It is our practice to segregate the fixed sum items of equipment in the specifications in a separate section so that we can furnish the specifications to equipment manufacturers without a deposit charge. Thus they are spared the expense of contacting all possible bidders, inasmuch as they have only the engineer or the ultimate purchaser to sell.

In our specifications, these fixed sum allowances for mechanical equipment are definitely indicated in the appropriate items in the form of proposal. The items of equipment and the accessories which the fixed sum in each case purport to cover are set out in detailed specifications. The bidder may assume that the

purchase price of each item will be as stated, including in all cases the sales tax and freight allowed to the City in which the project is being constructed. Also, where definitely stated, the fixed sum allowance may include the services of an erection engineer furnished by the manufacturer to supervise the installation of equipment but such service in no case includes the labor of installation. The bidder estimates the cost of unloading, hauling and installing and adds the same, plus profit, to the respective fixed sums as stated in preparing his proposal.

Prior to the time bids are received for the general contract, the engineer requests the manufacturers of various items of mechanical equipment to file with him their definite quotations and specifications. Following the award of the general contract, a decision as to the selection of these items of equipment is made and the contractor is advised in writing by the City or engineer of the particular items selected, the names of the manufacturers, the specifications upon which the equipment is to be purchased, and the actual purchase price of each item. The contract sum is then adjusted to compensate for any discrepancy between the actual purchase prices and the fixed sums set forth in the specifications and in the written proposals. The purchase transactions are between the contractor and the manufacturers of equipment. This places with the contractor the responsibility, and provides the authority for expediting deliveries, correcting departures from approved details, etc. In each case, the purchase agreement between the contractor and the manufacturer includes an appropriate guaranty against defects of workmanship or material, guaranteed efficiencies (if applicable) and protection of both contractor and city against failure to meet the requirements of the specifications. The contractor provides the city with a similar over-all guaranty under his required surety and maintenance

Almost without exception our clients appreciate the control that this system provides for the selection of equipment. Further, it has been our observation in municipalities where sewage works equipment has been selected on that basis, that officials are generally more conscious of functional quality, operational reliability and service made available by the manufacturer of such equipment. In other words, they have learned by experience that the first

cost of equipment is not necessarily the prime factor to be considered in its selection.

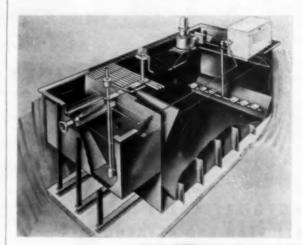
In our opinion, the engineer is obligated to give his client a thorough and complete evaluation of equipment under consideration. In the case of processing equipment, particularly equipment involved in new treatment processes, the engineer must protect his client with his best opinion as to its performance efficiency and estimated operational expense. We should be interested in, and encourage, the development of new equipment and new treatment processes. However, the manufacturer should be required to prove and guarantee his claimed performance at his own risk.

It has been our practice to decide first upon the functional requirements of the equipment needed, and then to obtain a preliminary cost estimate from two or more manufacturers as a basis for determining the fixed sum to be stated in the specifications and form of proposal. In recent expansion of the Cedar Rapids sewage treatment plant, these fixed sums for mechanical equipment and certain items of material amounted to approximately \$640,-000. The equipment purchased by the city was based on the recommendation of our office confirmed by the Superintendent of the sewage treatment plant. The equipment selected on this basis for the original plant in 1934 is, with few exceptions, still in operation.

The objectives of whatever system is used in specifying and selecting mechanical equipment should provide: 1) An engineering evaluation of functional features and relia-bility; 2) evaluation of operation, maintenance and repair as well as first cost; 3) recognition of the service and performance record of the manufacturer; and 4) the selection of equipment based on an over-all evaluation to satisfy the best interest

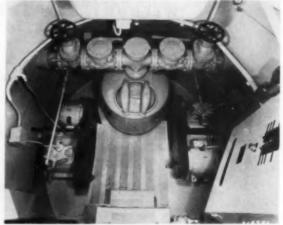
It goes without saying that the engineer will be held responsible by the client for the mechanical equipment he recommends. We believe this is right and proper for the reason that the engineer should have thorough knowledge of, and confidence in, the equipment he recommends. The client has every right to demand and receive competent evaluations of such equipment as a basis for final selection. A system to control the selection of mechanical equipment in the best interest of the client, therefore, is also protection for the engineer in performing his professional service.

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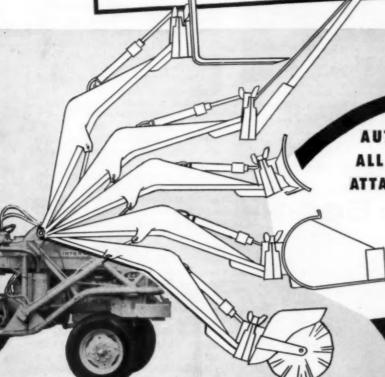


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ullet IN ADDITION to being a disposal area, landfill site furnishes caliche base material for street and subbase stabilization. Material is loaded at $4\frac{1}{2}$ ¢ per cu. yd.

Landfill Site Gives Double Benefit



LANDFILL site was formerly a dump. Old material is bulldozed into worked-out portion of pit. Refuse now brought to site is compacted in a trench and well covered.

FOUR-ACRE plot of ground is yielding double benefits for the City of Pearsall, Texas, and its 5,800 residents. The city-owned property not only offers a refuse disposal site but yields satisfactory base material, caliche, for street stabilization and subbase.

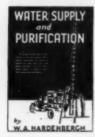
For years the land had been used as a dumping place for garbage and trash. Left uncovered, it soon became a breeding place for insects and vermin. To remedy the situation, a Caterpillar 933 Series F track-type loader with No. 2 ripper was purchased and put to work ripping and digging caliche out of an 80 by 110-foot pit on the property. In the space of 3 months, on parttime basis, the 933 dug approximately 100,000 yards of caliche out of the pit at an estimated cost of 41/2¢ per yard, according to T. J. Smith, superintendent of utilities. The ripped-out caliche is stockpiled temporarily at the site until it is needed for street construction.

The machine loads the material into seven 4-yard dump trucks leased by the city. Haulage costs average about 32¢ per yard. Dumped on city streets undergoing improvement or construction, the material is spread and leveled by a Cat No. 112 Motor Grader also owned by the city. The grader maintains approximately 45 miles of streets.

When all available caliche has been removed from the pit to an estimated depth of 18 feet, the old refuse will be dozed into it and covered by topsoil. Meanwhile, on the same plot of ground the 933 has excavated a 280 ft. by 14 ft. trench, 8 ft. deep, for the disposal of fresh garbage delivered at the rate of about 40 tons a week. The 933 spreads, compacts and covers the material biweekly with a 12-inch layer of earth excavated from the trench. The city's 16-yard Pakmor picks up garbage twice weekly in the residential area, daily in the business district. Collection costs average \$3.00 per ton; disposal costs, \$1.12 per ton.

In addition to its work at the landfill, other applications have been found to keep the 933 busy. These include preparing subgrade for streets to be paved, clearing trees and brush from edges of existing streets, preparing the right-of-way for municipally-owned gas, water and sewage lines; cleaning out existing drainage ditches and digging new ones. The 933 was purchased, Mr. Smith said, on the basis of past performance by the city's present and past Caterpillar motor graders.

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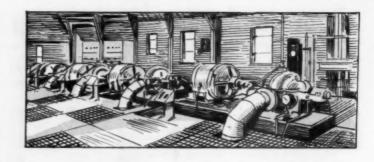
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Prepared by ALVIN R. JACOBSON, Ph. D.

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Improving a Water System

In 1957, when the new administration took office in the town of O'Fallon, Illinois, population 4,000, it immediately proceeded to obtain the service of an experienced water works operator to assist in a study of the methods used in the waterworks system and to submit reports and recommendations for improvements. An addressograph, with the necessary accessories for plate making, etc., was installed to facilitate and speed-up the job of addressing the bills for the 3,000 accounts on a quarterly basis, one third of the bills being billed each month. For meter reading and billing purposes, the system was divided into three divisions, each division with six to seven meter books. One division is read and billed each month. A careful study of all meters was made, the make, type, when installed and if in proper working order. Plans

are being made to set up a schedule for testing all meters in service over 10 years. The system has had a considerable growth over the past 12 years necessitating the need for revising the method of financing extensions. To provide a more adequate distribution system, as well as considering future growth, the City issued the following rules: 1). No two-inch pipe to be installed. 2). No galvanized pipe to be installed. 3). Developers will submit a plan to the City before development. 4). The City will specify the size of pipe and estimate the cost of installation. 5). The developer will deposit with the City the estimated cost of the installation. 6). The City will arrange for and supervise the installation. The accounting method was revised by the City to separate capital and operating expense and it is functioning in accordance with accepted practice. What has been accomplished in this public water system in a relatively short period

of time is ample proof of what can be done by a dedicated and aggressive administration.

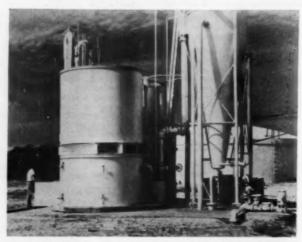
"Local Officials Can Improve a Water System." By Stephen C. Casteel, Water Utility Service, Belleville, Illinois. Water & Sewage Works, September, 1961.

25 MGD at the

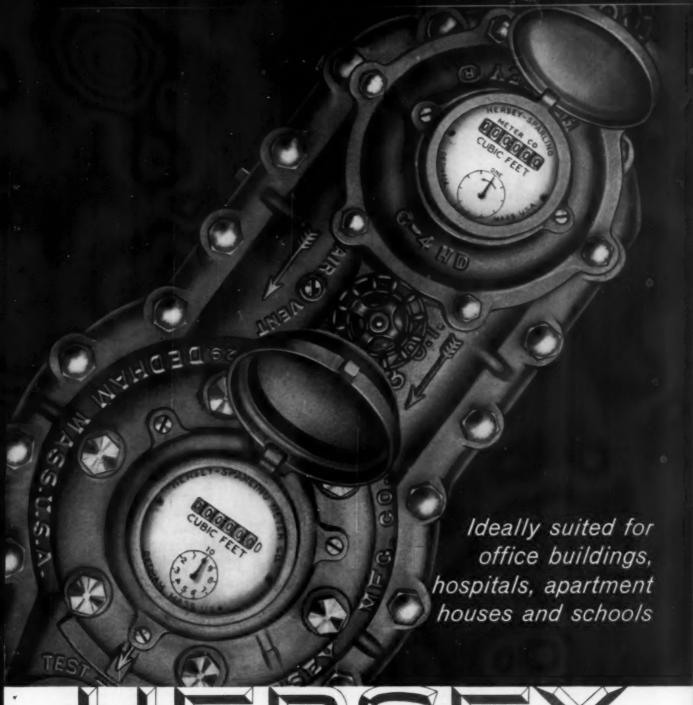
The new E. H. Aldrich Filtration Plant of the South Pittsburgh Water Company dedicated on September 20 is perhaps America's most automatic, supervisory controlled treatment plant. Many features, providing for ease and dependability of chemical treatment and economy of operation, characterize the \$6.5 million treatment plant and pumping station. Raw water will be taken from the acid-mine-wastespolluted Monongahela River; neutralized with soda ash; coagulated

Compact Plant Filters and Softens Water

TYPICAL of the rapid population and industrial growth beyond established public water supplies is General Development Corporation's new Port St. Lucie residential development in Florida. Shown here is a compact water treatment plant, built by The Permutit Co., Division of Pfaudler Permutit Inc., which serves the potable water needs of the community. The system is factory-built and easily assembled by local contractors at the site. Units at left are two automatic valveless gravity filters that cycle themselves from filtration to backwash, rinse, and back to service without special controls. At right is a Permutit Spiractor, a high-speed lime softener that removes the high calcium hardness of the well-water source in an eight-minute cycle. Large tank in background is the clearwell for storage of filtered, softened water. Capacity of the plant is 250 gpm.



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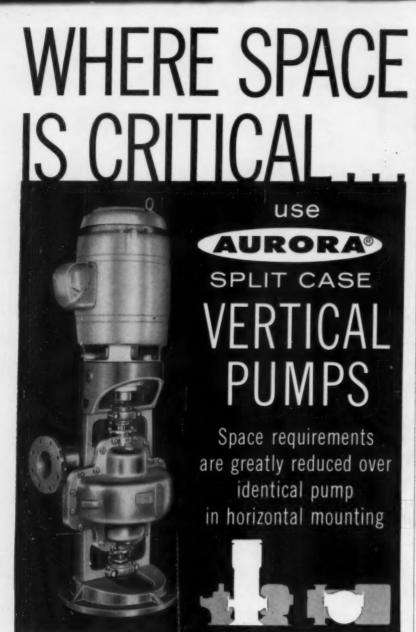
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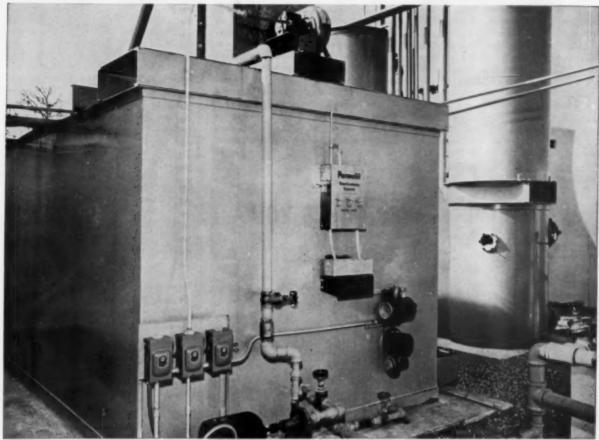
with alum and other chemicals as needed in four purification units, each outfitted with a Dorr-Oliver Hydro-Treator mechanism; softened-at times; and filtered-all of these processes being carried out with a minimum of manual attention and a maximum of instrumentation and mechanization. This plant is unique in the fact that nine different chemicals are used at times, all in liquid form. These are automatically fed in proportion to the volume and type of water being treated. Control features include remote central control of automatic operations, automatically filter paced application of chemicals and complete continuous recording of all operations at a central plant. Also included are the control of the remote operation of raw water intake pumps and relay pumps, as well as high-lift pumps, and the customary water level, pressure and flow recorders at numerous points. The plant has a capacity of 25 mgd, with provisions incorporated in the design to allow for future expansions to 100 mgd.

"25 MGD at the Push of a Button!" By E. H. Aldrich, Vice President and Engineer Consultant, American Water Works Service Company. Water Works Engineering, September, 1961.

Bucks County Master Plan

Historic Bucks County, in eastern Pennsylvania adjacent to the City of Philadelphia, is coming to grips with its twin problems of water supply and sewage disposal. Only 50% of its population is served by public water supply and only 40% by sewers. The County Commissioners have concluded that it is necessary to establish a master plan on a county-wide basis to best serve the needs of the many municipalities on a most economical basis. Consulting engineers and planners studied the problem and developed a plan for construction of facilities in stages to meet the expected requirements for the years 1965, 1985, and 2010. The first step in the study was to collect and evaluate data on existing water supply and sewerage systems. In analyzing the dependable capacity of the water systems, allowances were made for well yields decreased during drought periods, wells out of operation and inadequate storage capacity. Sewage treatment plants were evaluated according to the equivalent population they could handle. The

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second step in the study was to determine future requirements. This was accomplished by dividing the county into areas smaller than municipalities and along lines coinciding with boundaries of proposed water and sewerage regions, as far as practical. The resulting figures indicate a growth in the total county from 315,000 in 1960 to 828,000 by the year 2010, an increase of 165 percent. To determine total quantities of water required, per capita rates of water use had to be estimated. For design purposes, 80 gpd for 1960 was assumed for both water demand and sewage flow. This rate

was then assumed to increase at a rate of one percent per year, giving a value of 100 gpd in the year 1980 and 130 gpd in the year 2010. A time schedule was established for providing the required facilities. The basic plan was to provide water and sewerage facilities for any area at such time as its population reaches the limits specified in the study. The water supply will be developed from underground sources where feasible; from the Delaware River; and from impoundment of smaller streams. The Delaware River will continue in the future to be the principal receiver of

treated sewage, 75 percent of the sewage being treated in plants along the river. The remainder of the sewage will receive treatment in plants on smaller streams. All of the plants will provide secondary treatment. To implement this plan, the Water and Sewage Commission has recommended the creation of a county water and sewer authority and has also been conducting an active public information program in those areas where sanitary facilities are most needed and where regional cooperation is required. The entire cost of the 50-year program is estimated to be about \$97 million.

"County Master Plan for Water Supply and Sewerage." By Alfred A. Estrada, Executive Vice-President and Robert P. Heurich, Engineer, Albright & Friel, Inc., Consulting Engineers, Philadelphia, Pa. Public Works, October, 1961.

Reservoir Clearing Job

The Tarrant County Water District is clearing a dense hardwood forest from some 21,000 acres of a 38,000-acre site for Cedar Creek reservoir, one of the future sources of water for the City of Ft. Worth, Texas. Using its own personnel, this water district is using clearing blades mounted on the front of six new Caterpillar D8H and two D6B crawler tractors to remove the trees, averaging 10 inches in diameter, at a total cost (including overhead and supervision) of \$24 per acre. The reservoir will be 18 miles long, a maximum of eight miles wide, and an average of 35 feet deep and will impound 679,000 acre-feet of water, which will be piped into the Ft. Worth area some 85 miles away. A \$55 million bond issue was approved by the voters for the development of the reservoir, nearly doubling Ft. Worth's water supply. The clearing job began in January and is proceeding at a rate of 1500 to 1800 acres per month. The following technique has been developed for clearing the reservoir site: Working areas are laid out in a rectangular shape. The lead tractor marks the perimeter. The other D8's follow at 50 to 100-foot intervals and on a diagonal a blade-width apart. Using this "straight-line" method reduces twisting and turning to a minimum and all the machines can be observed from one location by the clearing superintendent. When the sector has been completely cut, the tractors then return to various



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The pipe was laid in open country and in town, in mud and in dry sand. Most of the job however was along city streets. Traffic was kept running smoothly and there was no interruption in water service. It was started in March and completed in October, two months ahead of schedule.

The 4.7-mile line is part of a loop around town to raise the general pressure level and provide a greater supply for fire protection.

Consulting Engineers for the project were Allen & Hoshall, Memphis. Contractor was J. B. McCrary Engineering Corp. of Atlanta, Georgia. The pipe was furnished by Price Brothers Company, Hattiesburg and Dayton, Ohio:

Price Brothers
CONCRETE PRESSURE PIPE



points along the perimeter and push the timber toward the center where it is stacked in piles. Diesel fuel is sprayed onto the pile to facilitate burning. The service and fuel-tube trucks accompany the tractors from sector to sector to eliminate any loss of time returning to a stationary service area. Servicing is done at night with light from a portable 10KW generator plant. A portable grinder is used for sharpening the cutting edges of the clearing blades.

"County Tackles 21,000-Acre Reservoir Clearing Job." By Ben F. Hickey, General Manager, Tarrant County Water Control and Im-

provement District No. 1, Fort Worth, Texas. Public Works, October, 1961.

Saline-Water Conversion

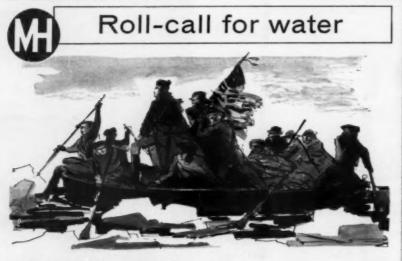
This report of Task Group 2270 P-Saline Water Conversion—discusses the principles, economics, and future applicability of some of the desalinization or demineralization processes currently being used or investigated, including distillation, electrodialysis, freezing, and solar energy. In addition, the present status of demonstration plants and

the need for further installations of this nature are discussed. A survey was made of the extent of brackish-water areas in the United States and Canada. Of 20,215 municipal water utilities in 50 states and 5 provinces, 1,066 had raw water with total dissolved solids of 1,000-3,000 ppm, and 31 had water with total dissolved solids in the range of 3,000-10,000 ppm. Brackish-water problems of significant interest are, or should be, of major concern in two areas, the northern Great Plains and the Southwest. The states of Minnesota, Iowa, North Dakota, South Dakota and Montana, and the province of Saskatchewan comprise the Northern Great Plains area; Oklahoma, New Mexico, Arizona and California are the states in the Southwest. Increasing emphasis must be given to the economic evaluation of saline-water conversion with respect to its competing water supply processes. The major competitor is conventional water supply, typically the impoundment of surface water or the tapping of ground water and the transportation of the raw water from the source to the point of treatment, and then distribution to the users. In some communities having brackish water, improvement of the existing public supplies by demineralization may require a substantial rise in water rates.

"Progress in Saline Water Conversion." A report of Task Group 2770 P-Saline Water Conversion, submitted by Rolf Eliassen. (Chairman), Prof. of San. Eng., Massachusetts Inst. of Technology, Cambridge, Mass. Other members of the committee are: J. D. Bakken, A. Cywin, L. S. Finch, W. E. Katz, L. Koenig, F. A. Loebel, R. W. Morse, and E. H. Sieveka. Journal AWWA., September, 1961.

Aquifer Drawdown

Although the pumping of water from an aquifer usually involves drawing supplies both from aquifer storage and outside inflows, the conventional theories consider only special cases, namely: 1) The development of conditions in the absence of inflows from outside sources; and 2) The stable conditions that usually do not occur until all the available storage water has been used up. In the more complete set of conditions considered in this article, outside inflows gradually take over from storage in supplying the water, and the supply patterns considered by Theis



Why Did Washington Recross the Delaware?

In 1776, General George Washington and his army crossed the Delaware river twice. The first time he was in retreat from British victories in New York. The second time was on the night of Christmas Day when he surprised and defeated the British at Trenton and Princeton, N. J. This turn of the tide of war heartened all American colonists, brought recruits flocking to join the American army and encouraged foreign sympathizers.

Today, Britain is our ally, but there are other nations which are not. Imagine what an atomic war might do to the great cities of these thickly populated South Atlantic states, where in 1607 the "English speaking race cast first root overseas and the United States began."

In these 8 states and the District of Columbia there are 100 water works, each serving 25,000 or more customers. Authorities rate 51 of them as adequate in facilities, 14 as doubtful and 35 as deficient!

America's peacetime shortage of water distribution facilities is a serious threat to a rapidly growing economy. But a wartime shortage of water distribution facilities could be fatal to the Nation's existence. As General Washington turned the tide of war, so must we do now in regard to water distribution facilities.

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Delaware

Maryland

Virginia

Georgia

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Unloading scene as IOWA hydrants are delivered by the carload to San Jose Water Works.

Two IOWA gate valves and a new hydrant being installed. Hundreds of these Iowa products are important components of San Jose's modern system.



Carloads of IowA gate valves and hydrants were purchased by the San Jose Water Works (an investor-owned, private company established in 1866) for installation in their rapidly expanding system which serves seven cities and unincorporated areas in Santa Clara County, California.

Over 17,000 new water service connections were made in the last two years along 1200 miles of water mains to help care for a metropolitan population (Approx. 306,000) which has doubled since 1950.

Iowa products were selected to be a part of the San Jose Water Works' growth because of their proved dependability with minimum maintenance and assurance of long-life performance.

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and Mme P. Kotsis shows a remarkable degree of symmetry at constant flows, the experimental verification of which may both confirm certain apparently more or less justifiable assumptions and the validity of extrapolations suggested by theory. A theoretical radius of influence is suggested for stable conditions where for a short-duration test, values are given by the ratio between the inflexion gradients of the "drawdown vs. log time" graphs for distances R_1 and R_2 respectively.

ly.
"Aquifer Drawdown." The linear theory and its application to tests."

Par J. Brillant. Ingenieur a la Société Solétanche. La Houille Blanche, Mai-Juin, 1961.

Water Intakes in Gabi Project

The present trend in creating hydro-electric power plants, collecting water from various valleys and concentrating it in a favorable site, leads to the need for increased performances from the water intakes, from the standpoint of efficiency as well as from the standpoint of their working conditions. The constructor of such intakes

seeks to satisfy the following conditions: 1). Security in operation. 2). Low supervision requirements. 3). Evaluation of solid contents with a minimum of water losses. 4). High collection coefficient. The writers describe intakes and the various adopted solutions in order to satisfy the mentioned require-ments, namely: 1). An intake combined with an automatic rocktrap. 2). An intake with a sandtrap incorporated into the dam. 3. A Tyrolian intake of a simplified construction, without any rocktrap. Considerations in regard to the operation of the various elements during exploitation will be looked into further, taking into account the high mountain conditions and altitude (about 5,000 feet) where the intakes will be installed. A special solution for a joint for the power channels prefabricated in prestressed concrete, frost-resistant, and which does not weaken the other elements is also described.

"Water Intakes in the Gabi Project (S.A.) Energie Electrique du Simplon. Par J. C. Ott, Ingenieur E. P.U.L., Sous-Directeur de la Societe Generale pour l'Industrie, Geneve, et F. Ullmann, Ingenieur E.P., Vienne, Directeur des Travaux de l'Amenagement de Gabi. La Houille Blanche, Mai-Juin, 1961.

Other Articles

"Water Utility Distribution Loss." Part 2. This series on water quantity accounting outlines the problem, discusses the utility system generally and the utility distribution system specifically. By Dale Smelser, Knoxville, Tennessee. Water & Sewage Works, September, 1961.

"Cooling Water for Air Conditioning."
Part 1. This series of three articles is presented to give readers an appreciation of problems surrounding the use of cooling water in air conditioning. Part 1 deals with water for cooling. By Henry F. Munroe, San. Engr., B-I-F Industries, Inc., Providence, R.I. Water & Sewage Works, September, 1961.

"Bioassays Determine Pesticide Toxicity to Aquatic Invertebrates." Median tolerance limits (TL_m) for various test organisms against several pesticides were obtained. By Arden R. Gaufin, Assoc. Prof., Loren Jensen, and Thomas Nelson, Graduate Students, Dept. of Zoology and Entomology, Univ. of Utah, Salt Lake City, Utah. Water & Sewage Works, September, 1961.

"Deep-Freeze" Main Repairs Make Warm Public Relations." Dry ice method for small mains is slower, but eliminates need for line shut-downs and inconveniences to consumers. By Ruby Proctor. Public Relations Assistant, Gary-Hobart Water Corp. Water Works Engineering, September, 1961.

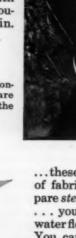
Planning a water main?

BOSTON chose STEEL PIPE

tested to AWWA standards

Last year Boston's Metropolitan District Commission Water Division completed an important water main extending three miles through Newton, Wellesley and Needham. They chose tar-enameled and wrapped steel pipe with mechanical and welded couplings in 36, 48, and 52-in. diameters in 40-ft. lengths.

Workers of the Wes-Julian Construction Corp. of Dedham are shown laying a 40-ft. length of the 52-in. pipe near Newton.



...these are inherent qualities of fabricated *steel* pipe. Compare *steel* pipe with other types ... you'll see why "wherever water flows, steel pipes it best." You can always specify *steel* pipe with confidence.

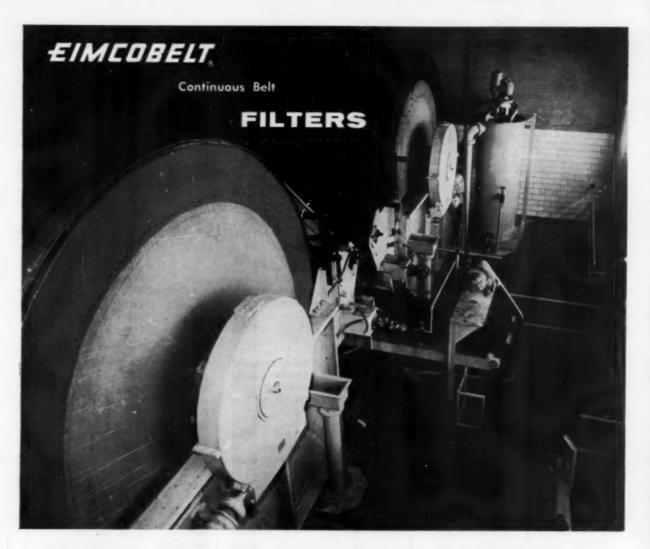
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Cake production rate 11.2 Lb/Hr, dry weight solids; dry FeCl₃ and CaO additions 1.6% and 6.3%; cake moisture 69.2% — these operating results are typical of average monthly performance with EimcoBelt filters at Central Weber Sewage Improvement District, Ogden, Utah.

The two 11½-ft diameter by 12-ft EimcoBelt filters with synthetic fabric media handle an undigested primary trickling filter sludge that is probably one of the most difficult to filter in the United States. Influent contains packing house, plating mill and cannery wastes, often carries

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The cloth belt filter media has been in continuous operation for over 1½ years, still going strong, providing efficient operation with negligible maintenance. Continuous wash sprays maintain the media in an unblinded condition.

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Prepared by CLAYTON H. BILLINGS, Associate Editor

Removing Organics By Foaming

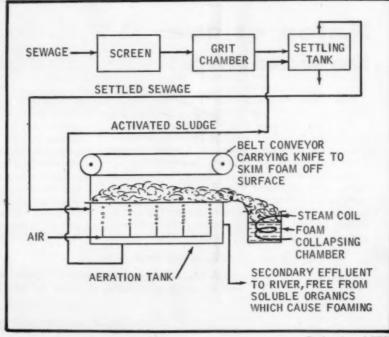
Many soluble organic compounds of industrial origin, such as detergents, insecticides, herbicides and solvents, are difficult to capture, identify and remove by known treatment measures. Foam fractionation, in use industrially in hydrocarbon and aqueous solutions, is a logical approach to the removal of dissolved organics which produce foaming. Among the purposes of this article were to describe how foam fractionation has been applied industrially, to show the feasibility of applying the method to treated waste water of industrial and domestic origin and to define areas of needed research. Foam fractionation is accomplished in a column containing the solution to be foamed and a receiving vessel. In batch-type operation, a gas such as air is bubbled through the solution. Foam is generated, rises to the top of the column, is collected in a separate vessel and is collapsed. In continuous operation, feed is introduced at the side of the column and overhead and bottom liquid fractions are collected separately. The method differs from froth fractionation in that in involves a single homogenous liquid phase. Froth fractionation takes place in a heterogeneous system involving two or three phases. Separation is achieved by modifying the particle surface characteristics so that it is more readily attached to air bubbles. A brief study showed that foam fractionation can be used to remove soluble organics from activated sludge effluent. This involved demonstrating the gradual lower-ing of the surface tension of distilled water mixed with varying portions of filtered effluent, and shaking samples of the effluent and alternately removing the foam layer. After seven such attempts, 87 per-

cent and 32 percent of the COD were removed. In actual practice, the aeration tank of the activated sludge plant can be used as the fractionating column, with foam collected at the surface, removed to another tank where it is collapsed for separate disposal. Foam fractionation can also be used to remove dyes and phenols (to some extent) from industrial wastes. Further areas for investigation are surface tension relationships, the effect of pH and ionic concentration, and the influence of solubility and surface activity. If foam fractionation cannot remove all of the soluble organics, it is possible that it could be combined with other techniques.

"Foam Fractionation for Removal of Soluble Organics from Wastewater." By I. A. Eldib, Esso Research and Engineering Co., Linden, N. J. Journal WPCF, September, 1961.

Industrial Waste Control in Milwaukee

Sewage collection and treatment in Milwaukee and its suburbs is a function of the sewerage commissions of the city and the county. It is estimated that the industrial waste population equivalent varies from 426,000 to 1,876,000; in volume, it amounts to 40 mgd with concentrations of 800 mg/L BOD and 665 mg/L suspended solids. No sewer service charge or surcharge on industrial wastes is levied, and to protect the investment in the sewer



Courtesy Journal WPCP

SCHEMATIC diagram shows how acration tanks are used as foam fractionators.

Link-Belt's creative answer to a critical sewage problem:

Complete, two-stage bio-filtration in one compact, low-cost unit

BIO-PAC

offers "Big City" sewage processing for the needs of 50 to 500 people

Link-Belt's Bio-Pac brings the economies and efficiencies of "big-city" bio-filtration sewage treatment to areas remote from metropolitan sewerage service. Single units are available to serve 50 to 500 people -perfect for housing developments, trailer courts, motels, shopping centers, industrial plants, schools and institutions.

Bio-Pac literally gives you a functional scaling down of large-volume sewage-plant concepts. Yet, the

"scaled-down" design is a matter of size only . . . no compromise of quality! Each unit is a highly efficient, two-stage bio-filtration system . . . built to meet the Ten State Standards for sewage works.

Even under adverse conditions, Bio-Pac produces a consistently stable effluent. It readily absorbs shock loads which frequently upset aeration-type units. And power requirements are much lower than for aerated systems. Important too, Bio-Pac is entirely automatic. Only parttime care is required . . . by personnel who needn't be highly trained.

Because of its exceptional compactness, Bio-Pac can be easily concealed through landscaping and other techniques commonly used in connection with electric service and water storage facilities.



BIO-PAC SEWAGE Treatment Plant 18,000 G.P.D. flow of sanitary waste. Installed at Houdaille Construction Material Co., Bridgeport Twp., near Bound Brook, New Jersey Plant.

Here's How Bio-Pac Works

PRIMARY FILTER SECONDARY FILTER PRIMARY SETTLING

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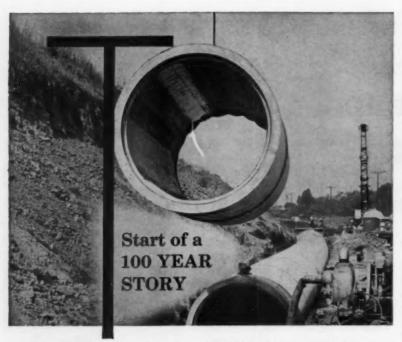
ROTARY DISTRIBUTOR Bio-Pac two-stage treatment starts with removal of the settleable solids in a primary settling compartment. Then, sewage is pumped to two bio-filters operating in series, where aerobic bacteria remove 85 to 95% of the suspended solids and B.O.D. (Biochemical Oxygen Demand). The last stage, a final settling compartment, completes the process of producing a stable effluent.

Sludge from both primary and final settling compartments goes into the digester. Disposal of digested sludge can be done on drying beds or by tank truck haul-away about once or twice a year.

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This reinforced concrete sewer will be in service generations from now, because concrete surpasses all other materials. Most concrete sewers do not require protection, but when strong chemical effluents or oxidized H2S are a problem, only T-Lock Amer-Plate provides positive protection. T-LOCK AMER-PLATE is a high molecular weight polyvinyl chloride sheet which is cast into the concrete while in the process of manufacture.

T-Lock Amer-Plate meets all the requirements of the ideal sewer lining:

- T-Lock is extremely dense and impervious. Permanently protects concrete from chemical effluents and H₂S corrosion.
- T-Lock is permanently flexible. Tensile strength minimum is 2200 psi; elongation at break is a minimum 200%.
- It is mechanically bonded to the pipe. Pull tests result in the breakage of concrete before T-Lock fails.
- T-Lock withstands 40 psi back pressure, equal to a ground water head of 85 feet.
- T-Lock has a smooth, highly abrasion resistant surface... maintains its N factor of .010 indefinitely.

There are no other materials - paints or troweled-on mastics, mortars, sacrificial aggregates or admixes - which meet these vital requirements.

Where protection is required, only T-Lock will do the job. Compromise methods are a gamble which experienced sewer designers will not take; they know it is money wasted to specify linings which will fail within a few years.

Because T-Lock Amer-Plate is the only completely satisfactory material on the market today, millions of square feet are now in use in cities throughout the nation.

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111 Colgate Ave. 2404 Dennis St. Buffalo, N.Y. Jacksonville, Fla.

system a set of rules has been established and enforced. These classify wastes into groups that have to be excluded, those requiring pretreatment before discharge to a water course and those requiring no treatment. Only three specific limits are used for the excluded wastes: 100 mg/L limit on fats, oils and greases; 5.5 minimum pH; and 140°F maximum temperature. In the second group are included those wastes which may be pretreated to a residual BOD equal to the Milwaukee treatment plant effluent. The rules require that all industrial waste pretreatment facilities must be approved before they can be constructed. The local plumbing inspector is expected to enforce the rules. In the case of existing facilities, pretreatment units are inspected weekly by Sewer Maintenance Department personnel. Problem sources are detected at the city sewage treatment plant. All wastes must enter the plant from either the high or low level interceptor. Knowledge of the areas covered by these interceptor systems makes it possible for maintenance personnel to isolate the section contributing offending wastes.

"Industrial Wastes Control in Milwaukee." By Lawrence A. Ernest, Industrial Waste Engineer, Milwaukee Sewerage Commission. Journal WPCF, September, 1961.

Byproducts from **Black Liquor**

The biggest success story economically for sulfite recovery operations from black liquor has been the Marathon-Howard process for producing vanillin and other chemicals, but this does not deal completely with the pollution problem. Other partial recovery successes are the production of Torula yeast by fermentation of low-yield black liquor and ethyl alcohol production by fermentation of the hexose sugars in low-yield liquor. The most satisfactory sulfite chemical recovery process is that practiced in integration with kraft pulping. Sulfite black liquor is combined with kraft black liquor to sustain partially the chemical requirements of the kraft process; hence, all sulfite chemical and organic matter is disposed of economically in the kraft recovery system. Sonoco Products Co., which has been fighting a pollution problem for years, produces 1400 tons of black liquor per day. Lagooning for treatment and disposal has been used mostly, but a recent development in chemical recovery showed

Mirrors, rectangles, and other tremendous trifles make **Shone®** your bargain buy in sewage ejectors



When 91 years of engineering and experience go into a sewage pumping device, there can be only one result—an ejector that is so much in a class by itself, it becomes an "institution"... a piece of equipment that keeps other ways of handling sewage perennially obsolete... a mechanism that makes embarrassing service interruptions and dangerous climbing in-and-out of manholes things of the past. Each part, each material, each contour, each surface of the Shone ejector has significance in the vital job of handling sewage.

1. Consider the mirror-like "superfinish" (you can actually shave in it) surfaces of the pilot valve slides and seat of the Shone's exclusive control system. Handlapped to perfection... only the weight of the valve slide plus pilot air pressure maintain the seal for decades of operation. Faces of the two parts fit so accurately that it is actually difficult to pull them apart. There is no leakage... opening and closing are truly positive. Parts do not wear "out of balance," because they are "broken in" before leaving the factory.

Piston valve and pistons are also "superfinished" to the same mirror-like surface... and a test of each valve assembly assures operation at only 60% of the minimum allowable pilot and operating pressure.

3. Or consider the singularity of rectangular valves in round pipes. Sticks and

stones in sewage may "bridge" in a round pipe under low-flow conditions. Not only are the Shone's valves rectangular, but they have a larger internal cross section than the pipes to which they are connected. This is one of several reasons why nothing (but nothing) can choke a Shone ejector in this "bottleneck" spot. Anything which reaches the receiver passes through it and through the discharge valve.

4. We all know cotter pins are fine on tricycles (and on external linkage), but not inside pneumatic ejector inlet and discharge valves. You can't find a more perfect snagger for rags and other strangulating debris. Shone has flush-driven pins on valve hinges, another tremendous trifle.

5. A newly-cast, iron receiver, like any good whiskey, needs to be aged. Receivers for Shone pneumatic ejectors are "mellowed" for up to one year. This settles them down, prevents cracks and warping by relieving internal stresses in the crystal structure. Remember that

Shone sewage ejector installations are usually considered permanent — the first U. S. installation, 1889, is still in service. An important invisible extra!

6. There are no "missing links" in the control linkage assembly of a Shone ejector. Each assembly is set, tested, dowled, and "match-marked" for its own particular receiver assembly. No trial and error fitting on the job. Another Shone "intangible" asset.

7. Tipsy control rods are obviously going to be less than 100% efficient. Shone bell rods are sober, straight, and only work with or against the forces of the bells and gravity. There is no side thrust to deform the packing seal. A trifle? No, a reason why Shone packing boxes go years without repacking.

8. Today, nothing is truer than "time is money." A special cast iron header, job tailored for each unit, holds field fitting, pipe cutting, etc., to bare necessities. Duplex units are complete with cross connections. The installer spends his time installing!

Would you like to hear more about how these and other design subtleties which make Shone the startling bargain in sewage pumping equipment?

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more promise. It is based on solvent extraction of black liquor with methyl ethyl ketone to produce formic and glacial acetic acids. Also, whole raffinate can be sold to kraft mills as fuel and salt cake make-up. For every ton of pulp produced, a yield of 134 lbs. of acetic acid and 15 lbs. formic acid is realized. Because market studies indicated that the rate of black liquor production would not be sufficient to make the recovery process economically feasible, Sonoco decided to boost its hardwood pulping to 350 tons per day and build the world's first formic-acetic acid recovery plant, using black liquor.

"Chemical Recovery from Pulp-Mill Waste Liquor." By D. Gray Weaver, Associate Editor in collaboration with W. A. Biggs, Jr., Sonoco Products Co. Industrial and Engineering Chemistry, October,

Effluent Flow Meter

A versatile method for measuring and recording waste flow from British industries recommended by Walker Crossweller and Co., Ltd., uses as a primary device a V-notch weir and stilling tank with a sensor consisting of a dip-tube containing compressed air. The pressure built up in the air line depends on the liquid height above the crest of the weir. The recorder is a straightforward pressure measuring device of the oil-sealed bell or slack diaphragm type, which uses a strip chart. Integrators can be supplied with the apparatus as well as switches for operating alarm gear. The advantages of the apparatus lie in its ability to record at a point remote from the waste producing area; corrosion resistant metals can be employed in the primary device; and where flow measurement must be made directly in a channel, a venturi flume may be substituted for the V-notch weir.

"Trade Waste Discharge—Recording Effluent Flow Measurement." Contractors Record and Municipal Engineering. (London). September 13, 1961.

Fish and Kraft Pulp Mill Wastes

In studying the effect of kraft pulp mill wastes on fish life in Japan, fish were exposed in crawls located in water contaminated by waste, and observed histo-pathologically. The interior organs—liver, kidney, spleen, and intestine—were

studied: each organ except the spleen was changed by the waste. The principal changes were the decrease of glycogen in hepatic cells, the decrease of ribose nucleic acids in the pancreas, the degeneration to polysaccharide in the kidney and the accelerative secretion and necrosis of epithelium in the intestine. These changes were used for the indicating symptoms to determine the effects of the waste on fish. From the results, estimates were made not only of the effects of oxygen consumption by the waste, but also of its toxic function. The histopathologically effective dose of the waste was estimated to be 10 to 50 mg/L COD, through the relation between the symptom of the fish exposed at each station occupied at various distances from the outfall of the mill and the distribution of the waste at the stations. The fish used, Sparus macrocephalu, of about 25 cm. length, were exposed 12 to 24 hr. in the respective stations.

"Effects of Kraft Pulp Mill Wastes On Fish." By Masaru Fujiya, Biologist, Inland Sea Regional Fisheries Research Laboratory, Hiroshima, Japan, Journal WPCF, September, 1961.

Microbial Treatment of Potato Wastes

Present plans for the expansion of potato processing plants in North Dakota and the addition of new units to existing plants made necessary a study of the effects of potato wastes on pollution and the tolerance of lagoons to the wastes. The plant chosen for the study was the Red River Valley Flake Plant of the Pillsbury Co. near Grand Forks. This plant processes raw potatoes to potato flakes. The total 24-hr. waste is about 200,000 gallons, with a pH of 11 to 12.5. The primary objective of the study was initial stabilization of the potato waste by reduction of pH and subsequent production of microbial cells and non-putrescible organic compounds. Only two organisms were found consistently in the waste, and of these Achromobacter was the most effective in reducing the pH of the sterilized waste, initially artificially reduced to pH 10.2 with carbon dioxide. This is a facultative aerobe and is suitable for survival in sewage lagoons. It was concluded that this acid producing organism could maintain the proper pH for stabilization of the wastes in the presence of city sewage, provided there is an excess of sewage. Additional studies are required to determine the effects of temperature changes, nitrogen sources and overloading of lagoons.

"Stabilization of Potato Wastes."
By John W. Vennes and Edwin G.
Olmstead, University of North Dakota, School of Medicine. Official
Bulletin, North Dakota Water and
Sewage Works Conference, October,
1961.

Progress in Paper Wastes Treatment

While the wastes produced by the pulp, paper and paper board industry have been cut 51 percent on a stream loading per-ton-of-production basis in the last 16 years, through the efforts of the industry, a 100 percent increase in production is anticipated. For many years the National Council for Stream Improvement has been interested in finding means of supplementing natural reoxygenation, and experiments have been conducted on the Flambeau River in Wisconsin. Use of diffused air has been tried but the cost of the method has prompted a search for other approaches, such as improving aeration equipment and application of surface active agents to increase the rate of solution of oxygen. Another method involves the introduction of air into the turbine draft tubes at power stations. The third method is providing weirs and cascades in streams receiving waste effluents. Removal of suspended materials has received more attention in the industry than other phases of treatment, and four unit processes are employed, any of which can do an effective job under the right conditions sedimentation, contact reaction, flotation and filtration. Dewatering and disposal of slurries in many cases offer the most troublesome task of solids removal-with vacuum filtration, flotation and seepage beds applicable only to some sludges. Investigations show that the disc and the conveyor type contrifuges hold promise, the latter producing cakes with 20 to 35 percent solids on boardmill, fine paper, de-inking and felt mill sludge. Work is being conducted on conditioning sludge for vacuum filtration by using fly ash and pulverized coal. In secondary treatment procedures, land disposal is gaining less favor with the diminishing availability of land. Mechanical aeration of lagoons is being used in many places to decrease the storage time required. New interest has been stimulated in trickling filters with the advent of

plastic media, offering greater surface area to volume ratios. However, activated sludge continues to provide the best method of reducing the BOD of effluents. The higher temperatures employed in the industry makes possible more rapid oxidation than is found in conventional sewage treatment. Contact stabilization, a modification of the activated sludge process, is being studied. However, the disposal of waste sludge is the most important remaining problem connected with the applicability of the process.

"Paper Production Goes Up-Wastes Pollution Goes Down." By Russell L. Winget, Executive Secretary, National Council for Stream Improvement. Wastes Engineering,

September, 1961.



FILMS in Brief

Listed below are motion picture films of current interest to engineers, administrators and supervisors in the public works field. The companies providing these films have indicated that the films are available for appropriate use by PUBLIC WORKS readers, Requests for films should be made direct to the company listed with the film.

"More Profits for Builders." Shows basic scaffolding set-up and how it is used in all kinds of construction and maintenance work. (20 min., color, sound, 16 mm.) Beaver-Advance Corporation, care of Thos. J. Barbre Productions, Library Division, 2130 S. Bellaire St., Denver 22. Colorado.

"Winterlude." How local governments limit damage and loss from snow by modern snow removal techniques. (10 min.) Morton Salt Company, care of Sterling Movies U.S.A., Inc., 43 W. 61st Street, New York 23, N. Y.

"Power for Plum Street." Portrays a new method for installing distribution transformers. Excellent for showing in training and safety meetings. (10 min., color, sound, 16 mm.) Motion Picture Department, Westinghouse Electric Corp., 3 Gateway Center, Pittsburgh 30, Pa.

"No One Else Can Do It." A strong persuader for supervisors who feel that safety is not a part of their job-one of a series of training films on safety and the foreman. (Black & white, 16 mm.) National Safety Council, in care of Associa-tion Films, 561 Hillgrove Ave., La Grange, Ill.

"From the Ridge to the River." The story of local watershed protection and flood prevention. Explains land treatments and work on water-courses. (26 min., color, sound, 16 mm.) Motion Picture Service, Office of Information, U. S. Department of Agriculture, Washington 25, D. C.

"The C-6." Describes the many features of this different concept in crawler design and shows sequences of the crawler at work. (17 min., color, 16 mm.) Advertising, Public Relations, Euclid Division of General Motors Corp., Hudson, Ohio.

"The Mapmakers." How aerial topographic maps are produced for engineering projects by photogrammetric methods. (13 min., color, sound, 16 mm.) Aero Service Corporation, Public Relations, 210 East Courtland St., Philadelphia 20, Pa.

"Arms for Industry." The story of the hydraulic crane, action of all boom functions and chassis capabilities. (18 min., color, sound, 16 mm.) Advertising and Sales Promotion, Austin-Western Construction Equipment Div., Baldwin-Lima-Hamilton Corporation, Aurora, Illi-

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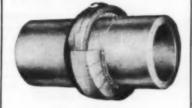
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(Continued from page 115)

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The distribution system employs prestressed reinforced concrete steel cylinder water pipe in sizes of 30inch, 24-inch and 18-inch, manufactured by Lock Joint and Price Brothers. The smaller pipe sizes-14-inch, 12-inch, 10-inch and 8inch pipe-are asbestos cement furnished by Johns-Manville. Other pipe suppliers included American Marietta, Armco and Bethlehem. The supply system, in all, comprises about 65 miles of pipe and furnishes water to many miles of older systems in addition to some 300 miles of new construction previously mentioned. This is only a start toward what is believed will ultimately provide water to every family within the bounds of the Water District. It is worthy of note that, for the past two years, the largest water districts created in the State of New York during those years have been in Niagara County. These districts, in the Towns of Lockport, Wheatfield and Niagara,

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are now in operation while another large district in the Town of Newfane is presently under construction.

About midway along the main supply line, an automatic non-attended booster station and 3 mg storage facility have been provided. This station is equipped with four Allis - Chalmers horizontal centrifugal pumps, one 50 hp and three 250 hp, all with a rated capacity of about 6 mgd each. These pumps can boost mainline pressure or draw water from the storage as needed without the necessity of human attendance. In addition to the 3-million gallon storage at this location, another reservoir of identical size and construction has been placed at the easternmost end of the system in Orleans County. These tanks are constructed of prestressed concrete and were built by Preload Concrete Structures, Inc.

The entire maintenance force consists of four men, while the office is staffed by an Administrative Director and a clerk-stenographer. Administration is handled by a seven-man Administrative Board of Commissioners who are, in turn, responsible to the Niagara County Board of Supervisors. Anthony L. Pusateri is the legal counsel to the Water District, while the consulting engineer is the author.

With the completion of this badly needed utility and with the completion of the new power project, the communities of Niagara County are now able to invite new industry and can look forward to an increasingly vigorous growth and development in the coming years. In anticipation of this growth and in keeping with the forward thinking of past years, the Niagara County Board of Supervisors, in co-operation with the Niagara County Planning Board, is actively engaged in studies toward the ultimate creation of a similar district for sewage collection and disposal which is rapidly approaching the problem stage in Niagara County.

. . . **Commuters Contribute**

Ebasco Services, Inc., economic consultant to the San Francisco Bay Area Rapid Transit District, reports its findings that, "Each commuter whose income is derived from work outside his county supports at least one other job for goods and services within his county. Therefore each commuter represents to his county of residence an economic value equivalent to the income from two job holders."

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PUBLIC WORKS

EQUIPMENT NEWS

Special Sprayer



Refuse Handler



This special air sprayer for applying a grass growth inhibiting chemical, the Myers Right-of-Way sprayer with an exclusive air-carry system, was developed through the combined efforts of Myers and the Agricultural Research Division of Naugatuck Chemical Company for the purpose of applying Naugatuck's grass inhibitor-MH-30 (maleic hydrazide). The main sprayer component is a 500-gallon skid-type unit with a two-stage centrifugal pump and an engine of sufficient size to operate the pump and provide up to 200 psi pressure at 100 gallons per

minute. This unit supplies the spray material to an air blower outlet, which gives complete and even coverage within a 30 to 80-foot area. A boom-type sprayer component provides coverage on open level terrain. All spray valves on the spray unit are automatically controlled from the truck cab, giving the operator instant control of valves when a change is needed in the spray operation due to terrain.

The F. E. Myers & Bro. Co., Ashland, Ohio.

Circle No. 11-1 on the convenient reply card facing page 34.

A refuse-handling unit, the Dow Packer, can be completely and automatically dumped in 9 seconds. This feature, together with the single-cylinder hydraulic actuator, which performs all loading-packing-dumping operations, gives the unit economy in operation and in maintenance. It fits on most 2-ton truck chassis and currently is available in 14, 16, and 21-cu. yd. sizes. One man controls all functions from easily accessible, grouped controls and from either side of the body.

Dow Packer Corp., 115 S. Main St., Fairview, Okla.

Circle No. 11-3 on the convenient reply card facing page 34.

Hand Radio

The Personal Messenger two-way radio for emergency service, traffic control, rescue work or other applications is housed in a highimpact case, with an elastic carrying strap. The radio may be carried in the hand or coat pocket, or is available with a leather carrying case and shoulder strap so that it may be carried like a camera. The unit is battery-powered and is equipped with a plug-in battery case for either standard pen light cells or the longer-lived mercury cells. Available as accessories, a rechargeable nickel-cadmium battery pack or a cigarette lighter adapter may also be used to power the unit.

E. F. Johnson Company, Waseca, Minnesota.

Circle No. 11-2 on the convenient reply card facing page 34.



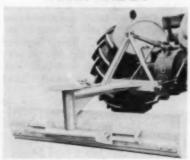
Two-Way radio may be carried in hand or pocket for battery-powered action.

Delineator

This roadway delineator, the Reflecto-Lite combines the advantages of wide-angle reflection and prismatic plastic. Visible at wide angles in headlights at night, these delineators continue to work as safety devices even when posts are bent out of position by accident or vandalism. The 3-inch center-mount reflectors are available in silver. amber or red, with or without an aluminum housing. Dustproof and waterproof, they can be fastened to a post with any non-rusting fastener up to 3/16-inch diameter. Delineator consists of a prismatic molded plastic face and back which seal in a wide-angle reflective sheet composed of glass elements. Minnesota Mining and Mfg. Co.,

900 Bush Ave., St. Paul 6, Minn. Circle No. 11-4 on the convenient

Rear Blade



The Model B-101 rear blade attachment for utility tractors has a replaceable cutting edge, nine angle positions and is reversible. The moldboard, 6-ft. long and 13-in. high, is made of blued steel. Cutting edge is %-in. heat treated steel, curved and beveled with standard punch. Model B-150 is also reversible and features nine angle positions, replaceable cutting edge, blued steel moldboard, and double strength pipe steel frame. In addition, the B-150 can be tilted 12° up or down and offset 20 inches to either side.

Parsons Co., Newton, Iowa. Circle No. 11-5 on the convenient reply card facing page 34.

Abrasive Drill

A line of abrasive core drills is offered for grinding holes in reinforced concrete and other hard materials from ¼" to 6" OD. For parking meter installation, street repairing, sign installation, anchoring machinery and the running of service lines, advantages are low cost, no bracing or running water required, inexpensive bits, low maintenance, and semi-automatic, portable machines.

Howe-Simpson Co., 136 E. Gay St., Columbus, Ohio

Circle No. 11-6 on the convenient reply card facing page 34.



Lane Detector

The Electro-Matic Model 1025 controller offers the means for the control of a high volume, two-phase intersection. The 1025 is an advanced form of volume-density control that balances the demand of the prime or most significant approach lane of traffic moving on the green against the demand of the prime lane having the red light. Each approach lane on both phases may exert its own demand-the lane having the stronger demand on each signal cycle governs the control for its phase. This control concept eliminates the possibility of heavy traffic in one approach lane getting less than its required green because of light traffic in other approach lanes on the same phase. The 1025 is a combination of components consisting of a main control unit, a power supply, and two or more volume-density detection units.

Automatic Signal Div., Laboratory for Electronics, Inc., Norwalk, Conn.

Circle No. 11-7 on the convenient reply card facing page 34.

Tandem Roller



Each roller wheel weighs 500 pounds.

The Rowco Rollking TD-1000 distributes its working load evenly between two tandem-mounted 18" diameter by 24" rollers, each weighing 500 lbs. when filled. Powered by a 4-cycle, 2¼-hp Clinton gasoline engine, this all-chain driven unit handles a variety of landscaping, improvement and maintenance jobs.

Rowco Mfg. Co., Inc., 48 Emerald St., Keene, N. H.

Circle No. 11-8 on the convenient reply card facing page 34.

Compressor Tractor



The Series 62 heavy Pneumatractor is basically a self-propelled 125 cfm air compressor capable of mounting a wide variety of accessories such as backhoe, loader, rock drill, post driver, tamper, angle dozer blade, rotary sweeper, snow plow, front winch and aerial tower. The compressor features "controlled delivery," a development which permits selection of 42, 84, or 125 cfm

capacity, as required, making it possible to operate pneumatic tools at the same time an accessory is being used. An independently mounted box steel frame, to which all accessories are attached, prevents stress.

Schramm, Inc., 900 East Virginia Ave., West Chester, Pa.

Circle No. 11-9 on the convenient reply card facing page 34.

Soil Mixer

This soil mixing machine, the Unimix 80, mixes and pulverizes material in the flat and also in a windrow. It is designed and manufactured to fit the small budget; it uses available tractor power that is also used for loading and back-hoe work.

Howard Rotavator Co., Harvard,

Circle No. 11-10 on the convenient reply card facing page 34.



Hydraulic Winch

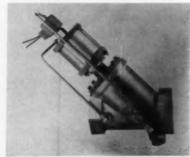
The Model 10 hydraulic winch has full hydraulic power and is capable of line pull of more than 17,000 pounds. Available with either larger cylinders for more power or smaller cylinders for more speed, the unit is constructed of fabricated steel and fits all tractors. It can be used wherever hydraulic power is available—no power takeoff is required. It may also be powered by an electric motor-driven hydraulic pump.

Windsor Pippin Corp., Windsor, Vermont.

Circle No. 11-11 on the convenient reply card facing page 34.



Solenoid Valve



A two-way, cylinder-operated, solenoid valve for control of raw water system intake, the unit controls flushing water to rotary screens for filtering debris from rivers and ponds at inlets to water treatment and pumping stations. Its "Y" type body configuration provides flow almost equal to a straight-through, gate-type valve. It is capable of handling dirty water that has been coarse screened only. Operation is directly off the main line pressure, requiring no auxiliary pressure source. The valve is supplied in 2", 21/2" and 3 N.P.T. sizes, with iron body, integral seat, resilient disc and watertight NEMA 4 solenoid enclosure. It can be mounted in any position without affecting operation.

Automatic Switch Co., Florham Park, N. J.

Circle No. 11-12 on the convenient reply card facing page 34.

Manhole Cushion



The manhole riser cushion combines steel and rubber to become a permanent operating part of the manhole casting, absorbing and dissipating road shock from heavy traffic. The riser cushion is available in round, square or rectangular shapes. The metal side of the cushion, resting against the manhole cover, insures free removal of the cover.

Utilities Supply Div. of Central States Industrial Supply Co., Terminal Tower, Cleveland 13, Ohio.

Circle No. 11-13 on the convenient reply card facing page 34.

Hot Mix Gate

The hot mix dump truck tailgate meters out two predetermined windrows of hot mix in front of the Repaver finisher. The Repaver finisher distributes the mix to provide a uniform one-half inch mat. This special tailgate eliminates hand labor from this operation.

Cutler Engineering Co., Div. of Asphalt Equipment and Engrg. Co., 5435 W. 63rd St., Chicago 38, Ill.

Circle No. 11-14 on the convenient reply card facing page 34.



Safety Delineator

The Safe-T-Post is made of a polyvinyl which when bent or run over, snaps back immediately to its original upright position. The color is a solid bright yellow clear through. A grey, iron base is painted with aluminum rust-retardent paint. Installation is made with expansion-bolts, a stud-gun or epoxy mastic. The polyvinyl tube can easily be replaced if damaged.

Radiator Specialty Co., Charlotte, N. C.

Circle No. 11-15 on the convenient reply card facing page 34.

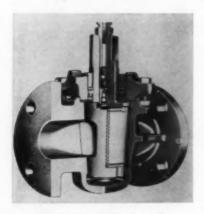


Plug Valve

A tapered plug valve utilizing a high lubricity plastic coating that reduces turning and provides maintenance-free operation, the Permaturn valves are designed to handle chemicals, water and sewage. For low pressure valves-recommended for pressures up to 1000 psi-the coating is Teflon, a polyfluoride thermoplastic with an extremely high softening point. For high pressure services-up to 10,000 psivalves are coated with phosphatemolybdenum disulfide. Both coatings are permanently bonded to the metal surfaces. A fixed adjustment assembly is used on low pressure valves to maintain a constant tight seal after repeated openings and closings and to facilitate uniform turning ease. A threadless stem results in a reduction of the high operating torques of conventional high pressure valves.

Rockwell Manufacturing Co., Meter and Valve Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

Circle No. 11-16 on the convenient reply card facing page 34.



Pump Control

The Multi-trol is designed to provide automatic on-off sequence control for pumps, valves or other rate-of-flow-controlled equipment. Valves or pumps are actuated automatically as needed according to the variations in flow. The Multitrol can be equipped with any reasonable number of adjustable contacts and can be field adjusted to meet local requirements. It may be used wherever there is an electrically operated Sparling differential type rate-of-flow instrument.

Hersey-Sparling Meter Co., 225 N. Temple City Blvd., El Monte, Calif.

Circle No. 11-17 on the convenient reply card facing page 34.

Truck Models



The 1962 line of Dodge trucks features 141 basic models, including conventional-cab, LCF, forward-control chassis, 4-wheel-drive, school bus chassis and tandem units. Seven Cummins diesel engines are available in the 1962 line, ranging from 160 to 250 horsepower. A closed crankcase ventilating system is standard on all 8-cylinder, 4-wheel-

drive models and is optional on all other gasoline models. All gasoline models are equipped with a 35ampere alternator as standard equipment, and a 40-ampere alternator.

Dodge Division, Chrysler Corp., 7900 Joseph Campau, Detroit 31, Michigan.

Circle No. 11-18 on the convenient reply card facing page 34.

Roadway Luminaire

This luminaire, called the Quadroliner, controls the lighting pattern on urban and rural roads. A unique open-bottom refractor is composed of four individual quadrants or sections. Each section is available in five different designs. Because of its open refractor, the Quadro-liner can be relamped and cleaned without unlatching or removing the reflector assembly. The luminaire can use incandescent or mercury lamps up to 250 watts. Photocontrols can be bought with the luminaire.

Westinghouse Electric Corp., Lighting Div., Edgewater Park, Cleveland. Ohio.

Circle No. 11-19 on the convenient reply card facing page 34.





Bark Mulch

Redwood bark offers important advantages when used in landscaping. As a mulch, it helps retain moisture, reducing costs for watering, and helps to assure successful growth even in areas with difficult access for maintenance. Decoratively it offers a color and texture that harmonizes with plantings, achieves a pleasing effect even in newly landscaped areas. The redwood bark is available commercially in tightly compressed bales weighing approximately 105 pounds.

The Pacific Lumber Co., By-Products Div., 100 Bush St., San Francisco 4, Calif.

Circle No. 11-20 on the convenient reply card facing page 34.

Pavement Breaker



The Woodpecker is completely hydraulic and reaches the job under its own power at speeds up to 55 mph. It is operated by one man. A controlled blow with an impact of up to 500,000 lbs. scores and breaks pavements of city, county and state specifications, at 1000 to 2000 sq. ft. an hour, depending on conditions.

Creeper speed is 14 ft. per minute, and efficiency is outstanding in gutter and curb cutting. All controls are at fingertip reach. The unit also tamps top lifts in trenches.

R P B Corporation, 2751 E. 11th St., Los Angeles 23, Calif.

Circle No. 11-21 on the convenient reply card facing page 34.

Space Heater

The Thor heater is a portable oilfired unit for temporary heating and drying in frigid or damp working areas on construction sites. Low pressure firing provides 0.90-gallon fuel consumption per hour, permitting the heater to operate thirteen hours continuously at low fire. The burner atomizes fuel centrifugally so there is no odor, smoke or buildup of fumes. Control of temperatures by output of 70,000 btu to 125,000 btu per hour, or any graduation in between, is possible by turning the dial from low to high. The Thor model weighs 42 pounds, less fuel, has dimensions of 303/4" length, 13" width and 261/2" height.

Thor Power Tool Co., Aurora, Illinois.

Circle No. 11-22 on the convenient reply card facing page 34.



Portable oil-fired unit for heating.

Parking Meter

The Mark-Time Sentinel meter increases the distances over which meters can be easily read. The white "time-remaining" against the red "time - expired" is viewed through a sealed, unbreakable window. Manually operated, the Sentinel is designed to require a minimum of maintenance. Damage caused by vandalism, bent coins or foreign objects can be repaired on the street. The sealed timing mechanism is dust-proof and weather-proof. The coinbox is also sealed and cannot be opened without detection.

M. H. Rhodes, Inc., Hartford, Conn. Circle No. 11-23 on the convenient reply card facing page 34.

Broom Filament

Keystrand broom filament is extruded from Enjay Chemical Company's Escon polypropylene, a chemically-resistant material with an extremely low water absorption point, spring characteristics, bend recovery and abrasive qualities to handle all types of sweeping jobs.

Keystone Plastics, Inc., 280 Badger Ave., Newark, N. J.

Circle No. 11-24 on the convenient reply card facing page 34.

Pavement Saw

The Model SB-12 concrete-asphalt saw is designed to meet the needs for short run cuts in concrete and asphalt. Available with either 7 hp gasoline or 3 hp electric motor, and utilizing a ¾" arbor, the saw enables the operator to use abrasive blades as well as standard concrete and asphalt cutting blades from 6 to 12 inches in diameter. A water feed attachment is standard equipment on all models for use with diamond blades. Where necessary an adapter for 1" arbor blades is also available.

Equipment Development Co., Inc., 2700 Garfield Ave., Silver Spring, Md

Circle No. 11-25 on the convenient reply card facing page 34.



Designed for short-run concrete cuts.

Chlorine Indicator

For measuring chlorine residuals, the Series A-780 Residual Chlorine Indicator is an electro-chemical instrument which analyzes treated water continuously. Residual chlorine (free or total) acts on a pair of electrodes in a sampling cell. A dc current proportional to the residual in a continuous sample is produced. This current controls an electronic indicator. The system is direct, uncomplicated and accurate. The indicator may be furnished in any one of three arrangements: To indicate residuals only; to indicate residual values and control alarms; and to indicate residual values and control chlorinator output.

Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J.

Circle No. 11-26 on the convenient reply card facing page 34.

Vibrating Roller



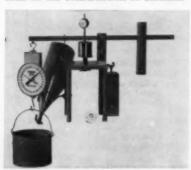
The VP-2G Vibra-Pactor is designed for use by crews who require a variable operating frequency of 1500 to 4000 vibrations per minute. It is recommended for high-frequency compaction of city and county roads, parking lots, sewer fills and bridge approaches. It is also valuable for shoulder work and bituminous repair. The vibrating mechanism consists of four synchronized eccentric weights which are timed with hardened gears and fully enclosed in an oil-tight case. Powered with a 7 hp engine, the 3200-pound vibrating force delivers a maximum applied force of 4950 pounds at 4000 vibrations per minute. When used as a static weight roller, it may be filled with 169 gal. of water to bring total weight up to 3116 lbs. The VP-2G Vibra-Pactor can be towed by small wheeltype tractors.

Bros Incorporated, Minneapolis 14, Minn.

Circle No. 11-27 on the convenient reply card facing page 34.

Soil Bearing Tester

A bearing ratio apparatus developed by the Florida Highway Department, and called the Florida Bearing Ratio Apparatus, is designed for use by highway departments, road contractors, testing laboratories and consulting engineers for fast evaluation of the bearing characteristics of friable soils in the construction of embank-



ments and subgrades. The apparatus can be used in either the laboratory or in the field. It can also be used to test aggregates for use in sand-bituminous road mixes. The soil or aggregate is contained in a small cup. A bearing plate is placed on top of the sample and loaded through a lever arrangement. The entire apparatus is self contained. No electrical or other connections are required.

Soiltest, Inc., 4711 W. North Ave., Chicago 39, Ill.

Circle No. 11-28 on the convenient reply card facing page 34.



Aerial Bucket

The yoke-suspended MV-50 twoman bucket pivots on the center line of the center of gravity inside the yoke. This suspension design and sufficient upper and lower arm travel, coupled with continuous rotation, permits linemen to work over parked cars, over and between power and telephone lines and on the property side of the pole. The leveling system automatically keeps the bucket level. The unit reaches up to a 50-foot working height, out 30 feet and will handle 450 pounds in all positions. It is made of quarter-inch-thick molded fiberglass reinforced plastic.

Holan Corp., 4100 W. 150th St., Cleveland 35, Ohio.

Circle No. 11-29 on the convenient reply card facing page 34.

Footing Cutter

A "T" footing cutter has been developed as an attachment to the Ditch Witch trencher line. A unit can be mounted on any trencher in the M3 and M4 series to dig a foundation footing with 8" stem and 16" footings. For the heavier jobs,



a 12" stem, 24" footing cutter mounts on the K2, 4-wheel drive. Witch Marketing Co., 1959 West Fir Ave., Perry, Okla. Circle No. 11-30 on the convenient

Circle No. 11-30 on the convenien reply card facing page 34.

Throwaway Broom

Worn gutter broom segments can be replaced in minutes with the Uniloy gutter broom, designed to take the place of the standard rewireable metal segments. The unit is prewired, ready to slip into place. The steel brush wire is fabricated of premium grade domestic steel.

United Engineering Mfg. Co., Box 248, Covina, Calif.

Circle No. 11-31 on the convenient reply card facing page 34.

Lift Trucks

Seven lift trucks featuring power steering as standard equipment, have capacities ranging from 6,000 through 10,000 pounds. The Allis-Chalmers six-cylinder Power-Crater gasoline engine, developing 77 hp, powers the models. These engines, as well as LP gas and Diesel units are available.

Allis-Chalmers Mfg. Co., Milwaukee, Wisc.

Circle No. 11-32 on the convenient reply card facing page 34.



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Another City Joins Cast Iron Pipe Century Club

Last summer Augusta, Ga., was made a member of the Century Club of the Cast Iron Pipe Association. At the ceremonies, a reenactment of the laying of the first length of the pipe was staged. A section of the original pipe was presented to M. P. Phillips, city engineer, acting for Glover Cushman, water superintendent, who could not attend. This first cast iron pipe in Augusta was laid in 1859, prior to which time wooden mains were used.

Inter-American Association of Sanitary Engineering

The eighth biennial meeting of the Inter-American Association of Sanitary Engineering will be held in Washington, D. C., June 10 to 15, 1962. This meeting will have especial importance because the Punta del Este Declaration is under implementation. For fuller data address AIDIS, Office of Public Health, I. C. A., Washington 25, D. C.

. . . South Dakota AWWA, WPCA and WSW Conference

At the meeting in Rapid City, S. D., in September officers were elected as follows: For the S. D. Water and Sewage Works Conference, Darrell French, president, Huron; and C. H. Murschel, vice president. For the S. D. WPCA, N. A. Erickson, Sanator, president; and Siger Bies, Aberdeen, vice-president. Don Kalda, Pierre, is secre-tary-treasurer for both. For the S. D. Section, AWWA, Don Wessel, Rapid City, was elected chairman; James Cox, Sioux Falls, vice-chairman; and J. D. Bakken, secretarytreasurer.

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by Arthur K. Akers

- ★ Sprague & Henwood, Scranton, Pa., is spreading out, with a new western regional office in Salt Lake City under Robert R. Carver, vicepresident. Joseph R. Parker becomes regional manager, Mt. Juliet, Tenn.
- ★ David D. Ackerman appointed director of sales development, Water Works Division, Darling Valve & Mfg. Co., Williamsport, Pa. John B. Moriarty is named Eastern Regional Sales representative for Darling, in New York Metropolitan area.





Mr. Ackerman

Mr. Barney

- ★ Tom Barney, formerly general sales manager of Pfaff & Kendall, Newark, N. J., appointed sales manager of Kerrigan lighting products, Kerrigan Iron Works Co. Division, Nashville, Tenn.
- ★ Henry A. Perkerson, nationally known as "Perk," assistant sales manager of M&H Valve & Fittings Co., Anniston, Ala., died suddenly Sept. 26. Few men have been as widely known and respected in the water works field.
- ★ National Safety Engineers Inc., Birmingham, Ala., makers of highway signs, becomes Vulcan Signs and Stampings Div., of Vulcan Materials Co., under John E. Montgomery, vice-president and general manager.
- ★ Hagan Industries of Corona, Long Island, manufacturers of Morse-Boulger incinerators and City Tank Co. refuse collection bodies, names J. J. Wuerthner vicepresident and assistant to President John G. Hagan.

- ★ Gale E. Allen becomes executive vice-president, Highway Equipment Co., Cedar Rapids, Iowa. He will continue his chief responsibility in sales and advertising as well.
- ★ Darrel D. Byerley promoted to general sales manager, Detectron Div., Tinker & Rasor, San Gabriel, Calif.
- ★ Chemical Division of Pittsburgh Plate Glass Co. (formerly Columbia-Southern) appoints Paul A. Fodor, Jr., director of sales.
- ★ Wentworth Smith resigns as vicepresident, marketing, of Neptune Meter Co. He will continue representation of the company in various associations.
- ★ John L. Barker becomes vicepresident and general manager of the Automatic Signal Division at Norwalk, Conn., of Laboratory for Electronics Inc., Boston.
- ★ Dresser Industries opens enlarged Los Angeles offices for its Roots-Connersville Blower and Clark Bros. Engines Divisions, at 5915 E. Sheila St.
- ★ Chain Belt Co. names Charles E. Smith eastern regional sales manager, and Wayne J. Leddy sales engineer.
- ★ Frank M. Lukacs promoted to assistant general sales manager, Willys Motors (Jeeps). He will be responsible for all field sales operations.
- ★ Windsor Pippin Corp., manufacturers of backhoes and loaders, merged with Mersick Industries. Pippin headquarters remain in Windsor, Vermont.
- ★ A Tax-payer is a person who doesn't have to pass a Civil Service exam to work for the government.
 - -Mercersburg (Pa.) RO-MER



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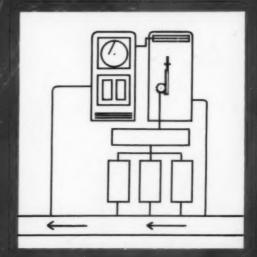


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